# UNSCHEDULED OUTAGES IN FAA'S AIR TRAFFIC CONTROL RADAR DATA PROCESSING SYSTEM



## HEARING

BEFORE A

## SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

NINETY-FOURTH CONGRESS

SECOND SESSION

OCTOBER 19, 1976

Printed for the use of the Committee on Government Operations



U.S. GOVERNMENT PRINTING OFFICE
79-971
WASHINGTON : 1976

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## APPENDIXES

# UNSCHEDULED OUTAGES IN FAA'S AIR TRAFFIC CONTROL RADAR DATA PROCESSING SYSTEM

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TUESDAY, OCTOBER 19, 1976

House of Representatives,
Government Activities and
Transportation Subcommittee
of the Committee on Government Operations,
*Indianapolis, Ind.*

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 202, Federal Court House, 46 East Ohio Street, Indianapolis, Ind., Hon. Wm. J. Randall (chairman of the subcommittee) presiding.

Present: Representatives Wm. J. Randall and David W. Evans.

Also present: Miles Q. Romney, counsel; and Richard M. Tempero, minority professional staff, Committee on Government Operations.

Mr. Randall. The Government Activities and Transportation Subcommittee of the House Committee on Government Operations will come to order.

Let the record show we are in the Federal Court House in Indianapolis, Ind., at 5 minutes past the hour of 10 in the morning.

Our hearing this morning concerns outages and momentary interruptions of the computerized air traffic system of the Federal Aviation Administration.

We, as a subcommittee, have an oversight jurisdiction over the efficiency and economy of the Federal Aviation Administration, which, as we know, is an agency of the Department of Transportation, and therefore is under the clear jurisdiction of this subcommittee.

The hearing this morning has been planned for some time. This subcommittee has prepared a series of reports on the Federal Aviation Administration, been out to Oklahoma City, taken a long and serious look at the procurement practices of the Federal Aviation Administration. We have been, I believe it is objective to state, quite critical of their implementation of recommendations of the National Transportation Safety Board. In this Congress during the last 2 years, we have taken a considered, careful, and prolonged look at not only the selection and training practices out at the FAA Academy in Oklahoma City, but also how some of this training has been translated into the efficiency of air controllers. We have spent quite a little time on some near midair collisions, near misses as we call them, particularly the one in the Lake Michigan area, and some of the other human errors related to the FAA's air traffic control system.

We are dealing with many people here. FAA has 57,000 employees. There are some 20,000 air traffic controllers, operating two categories of centers, en route centers as they are called, and then terminal facilities.

When we use the word "facility," we will be using it this morning to distinguish the word from the operation of a facility. When we consider a facility, we are talking about computers, a huge, complex and highly technical system, which seems to be constantly being updated and modified.

The purpose of this hearing is to be certain that the public welfare of those that are in the planes, flying the planes, is not overlooked in all this complexity.

We are dealing with a serious matter here, because of the importance of the lives of those who fly.

We have in the United States 20 air route air traffic control centers. We have one right here in Indianapolis. We are all familiar with the one at Leesburg, Va., near Washington. They are scattered throughout the eastern part of the United States, the Midwest, and on the west coast.

We have been told that some of the interruptions here are momentary. Others of longer duration are called outages. Now, we are going to try to find out, at least, where you divide the line between what is called an interruption and what is called an outage; whether there is any magic in the figure of 50 seconds or 1 minute or 1 minute and 10 seconds. We are going to try to discover who has defined that and why it is defined that way.

The report we have received is that we have had a lot of interruptions here at Indianapolis. After our distinguished colleague who represents this area has made his statement, the Chair is going to read into the record an article that was written by Ann Dooley, a staff writer for the magazine Computerworld that hits pretty hard. We are going to come back to that several times in the course of our hearing this morning.

As a preliminary, it may be well to give a brief description of the air traffic control system we are dealing with.

During the past 2 years there has been installed in all of these 20 centers a new radar system known as RDP, Radar Data Processing; it is also called narrowband radar. It provides detailed information on the radar scope and does so automatically and continuously. It constantly updates the information on the scope. I think it is fair to say that as a result, air traffic controllers can handle more aircraft than by using the old system, which was called broadband radar.

The old broadband radar system, however, is retained by all centers for a backup, if and when the narrowband system should fail or be shut down for maintenance.

The RDP consists of complex data processing machines, in other words, computers, some of them quite large. Because of the complexity and the size, there is more room and more chance for system errors that lead to these interruptions of the signals.

Now, we are told that in an interruption the display on the scope is frozen, or it is just literally blank, there is nothing there. We are also told that in an ordinary situation, these interruptions are self-correcting and the information comes back. There are other interruptions called outages, where the scope becomes blank; there is nothing there. Manual intervention is necessary to restore service.

Because electrical power is the energy source, the failure of that power can, of course, cause outages, as distinguished from interruptions. And this is especially serious because it affects the narrowband system, and also the broadband, which is the backup, at the same time. Of course, electric power failure can happen anywhere, but it is good to note and we have found that when there is such a power failure, there are backups consisting of diesel generators and storage batteries.

Now, where both narrowband and the broadband are lost, flights are going to have to go back to a control method by which each flight is recorded and maintained often by hand. It comes down to the matter of direct voice radio communication with each aircraft.

The thought just occurred to the Chair that maybe this is not all lost and not all a waste of time, because it gives the press and others who may be here an opportunity for a little preliminary information as to what we are going to be talking about later on.

Now, of course this latter method, the flight progress strip system, is much less efficient. It requires much greater separation of aircraft in flight. It becomes necessary to keep down the number of aircraft coming into a center sector, and in many cases it is necessary to hold on the ground those planes about to depart until the proper control can be resumed.

From June 1, 1976, through July 10, 1976, the Indianapolis center had 97 momentary interruptions and 29 system outages. And again we come back to the definition of what is an outage and what is an interruption.

I understand the largest single cause of these interruptions and outages has been in the computer software. That means the computer programs. And I think it is accurate to say that not all interruptions and outages can be easily and quickly diagnosed.

Now, we understand that the FAA is trying to improve its understanding and control of these interruptions and outages. Yet the FAA seems to be saying, at least as we read this preliminarily, that safety just does not suffer because they have these backup systems and other procedures that go into effect. We want to explore this issue during our hearings, since it is difficult for some of us to see how interference with system efficiency could fail to have some effect at the same time on safety, passenger safety, in those planes flying around, trying to find a place to land.

We want to learn firsthand about system interruptions here at the Indianapolis center and generally throughout the entire air traffic control system. We are going to try to get an evaluation of how serious they are, or how serious they can become. We want to hear from the controllers themselves, which we will be privileged to do after a while. We want to know very certainly what is being done here at Indianapolis about these interruptions, and also nationwide. We want to know how management, that is the FAA, is reporting these system errors, not only statistically, for record purposes, but, for effective analysis, that can lead to some prompt action to reduce these interruptions. That is the objective—reduction or elimination of these interruptions as much as is humanly possible.

Before introducing our first witness, I want to yield to our distinguished, able, and conscientious colleague on the subcommittee, Representative Evans. You hear a lot about Congress today. There is a lot of comment about an effective Congress. The fact remains that for any record the 94th Congress has made, the work is done in committee.

Of course, there is the debate on the floor, but the work is accomplished in committee.

I want to say, before I introduce this gentleman, as chairman of this subcommittee, he has been present with us 95 percent of the time. That is why it is my privilege to come here and help try to solve these problems in Indianapolis. But these problems are not his alone, as we have said. He is trying to help Indianapolis and also traffic problems in the several States which are under this Indianapolis en route center.

It is a privilege to yield to my valued and respected colleague, the gentleman from Indiana, Mr. Evans.

Mr. EVANS. Thank you very much, Mr. Chairman.

It is a privilege and an honor to have you here in Indiana today for this hearing. You have certainly served the House well since being elected in 1958 and certainly distinguished yourself as the chairman of the Subcommittee on Government Activities and Transportation. When you retire from the Congress in January, you are certainly going to be leaving behind a distinguished record of service. And the subcommittee will certainly miss your determined leadership this coming year, I am sure.

I would at this time like to thank Federal Judge William Steckler for making this courtroom available to the subcommittee for this hearing today.

The oversight responsibility of this and other congressional committees is, I believe, an important and a constant process which provides Congress with the kind of insight and information needed to make the laws of this land.

In this particular case, the Subcommittee on Government Activities and Transportation of the House Committee on Government Operations is mandated with an oversight role that includes the Department of Transportation and, as you mentioned, more specifically the Federal Aviation Administration.

Besides being in the Sixth District, our airport is the largest airport in the State of Indiana. Literally thousands of people fly through the airport, enter in and out of the airport each day. As a result, any problem that affects the safety of air traffic at Indianapolis Airport, the control center located here at Weir Cook Airport, affects people that land, depart, and fly through this center's area of jurisdiction.

I first became aware of possible problems existing at the air traffic control center in Indianapolis this past summer when I conducted several meetings and earlier had had the privilege of visiting the center. I learned that the Indianapolis center was experiencing, even in the opinion of the FAA, an unusual number of interruptions in the narrowband radar system. Later in the summer, my office gathered data concerning the performance of the RDP in Indianapolis, from the FAA and from controllers located here, in order to try to get a better understanding of the problem.

In August, I met with Mr. Sharp and several other gentlemen from the FAA in Washington to talk specifically about some of the problems being encountered here at the Indianapolis center. And I must say they were most helpful in assisting me in the development of my information at that time.

After meeting with these gentlemen in Washington, we tentatively agreed that a closer examination of the problem in Indianapolis and some of the corrective actions that they said were instituted would be effective in terms of helping better understand the performance of the narrowband radar system.

While the problem of the interruptions at the Indianapolis center is a local problem, it is overall a national problem at the same time, since this same type of radar system is used in 19 other air traffic control centers throughout the country. And while the testimony we will hear here today will be in relation to the Indianapolis center primarily, much of this information is also going to be helpful, I am sure, in gaining a better understanding of how the entire system works and, hopefully, how it can be refined to work out some of the problems, and, most important of all, how air traffic control and air travel in this country can be made safer.

Mr. Chairman, let me turn the meeting back over to you.

Mr. RANDALL. Thank you very much, Mr. Evans.

The Chair said a moment ago he was going to read into the record an article that had been published in a publication called Computerworld. This article is dated September 20, 1976, written by Ann Dooley. I read this so that the gentlemen assembled here from the FAA may have an opportunity to take their notes and respond to it. It is pretty hard hitting. It has a dateline of Indianapolis, but it does not apply to Indianapolis alone.

The matter is as follows:

Air controllers at the Indianapolis Air Traffic Control Center here have charged they were out of touch with aircraft in flight at least 126 times in a recent 40-day period because the Federal Aviation Administration's computerized air traffic system failed.

"We have no idea why the system is gone or when it's going to come back. When you're playing with planes at 500 or 600 miles an hour, it can be dangerous," Dave Morton, an air traffic controller said.

Since 1974, when the radar data processing (RDP) or narrowband radar, was implemented at the twenty air-route traffic centers which comprise the nation's air tracking control operation, momentary interrupts or outages have occurred, leaving the system virtually non-functioning.

At those moments, controllers have no radar contact with aircraft and must immediately decide whether to wait for the system to come back up or to switch to the non-computerized and less informational backup system. Such a decision could be critical depending on the number and proximity of planes in an area.

While the time to switch to the backup method is short, controllers have complained it is difficult for them to adjust back and forth to the different systems.

After originally denying reports of the number of failures FAA officials admitted to Representative David Evans (D. Ind.) that the Indianapolis center had 97 outages of less than a minute and 29 blanks of more than a minute from June 1 to July 10 and said the reported failures in the system constitute "real and valid cause for high-level concern."

Controllers said they believe the number of outages to be closer to 20 to 30 a week, however.

The outages can occur for a number of reasons, some of which can be inefficient programming or insufficient software; the controllers have complained they are the ones left to correct the mistakes.

"You get so used to the presentation of the data, you get too dependent on the machinery and then it's taken away from you so quickly and with no warning.

It's good to modernize, but we just can't depend on this system any more," Morton said.

Many controllers feel the system has actually increased their workload from a purely mechanical standpoint. Before the RDP system became operational, two people watched plane routes on a screen; now there is only one person to do the same job, because the second person is working on the computer, and that creates more strain on that one person, the controllers claimed.

While the entire national network has had outage problems, one of the most potentially dangerous situations occurred here at the Indianapolis center last June when lightning struck the system and the entire power supply went out.

In that instance, even the backup system was unable to work and controllers could only make contact with aircraft by radio.

Controllers had to manually hand off aircraft to other centers during the blackout, which lasted for forty-five minutes, according to William Hirchert, deputy chief of the Indianapolis Air Traffic Control Center.

"It's the nature of our business; there is no waiting, you just have to take action and the controllers did an excellent job," he said.

In response to the failure, Evans began an investigation and he and FAA officials will review the center next month to ensure corrective changes have been implemented.

Critics of the RDP system have charged there has never been sufficient testing. (CW, May 7, 1975). They believe the system was put into use before the FAA knew enough about the problems that would occur in such a large and complex system.

The FAA claimed that adequate testing did occur and that the system was certified before it became operational. The Airways Facility, the group which certified the system, is part of the FAA, however.

Since the ultimate decisionmaking is up to the controllers, Morton feels they should have more training with the computer itself.

"We were supposed to get 34 class hours and six hands-on hours and I ended up with 18 class and one-and-a-quarter hours of hands-on training," he said. "And after that we're supposed to sit down in front of a monstrosity that has 128 buttons and can do probably 500 different functions and make these emergency decisions."

While the FAA said the system is continually being refined, controllers are unhappy that the outages continue to occur.

The narrowband system follows the location of an aircraft along its course and also indicates the aircraft's identification, altitude and speed.

The RDP system consists of the central computer complex, composed of an IBM 9020 system, and channel display system developed by Raytheon Corporation.

Now, we believe it is justified that this critical article be inserted in the record so that those who are here from the FAA and the controllers may have an opportunity to respond.

It is our understanding that our first witness this morning is Mr. Warren Sharp, the Director of the Airway Facilities Service of the Federal Aviation Administration. He is not situated here in Indianapolis; he comes from Washington.

Before you begin, I think the Chair might make the caution and admonition he does everywhere. The purpose of any congressional hearing is for the benefit of Members of Congress in order that there might be corrective legislation or at least that there might be recommendations to correct some existing deficiencies in the economy and efficiency of any operation.

Now, would you proceed, sir.

**STATEMENT OF WARREN C. SHARP, DIRECTOR OF THE AIRWAY FACILITIES SERVICE, FEDERAL AVIATION ADMINISTRATION; ACCOMPANIED BY GERALD L. THOMPSON, CHIEF, AUTOMATION ENGINEERING DIVISION, AIRWAY FACILITIES SERVICE, FAA; JOHN TRUHAN, CHIEF, AIRWAY FACILITIES DIVISION, GREAT LAKES REGION; KENNETH PATTERSON, DEPUTY CHIEF, AIR TRAFFIC DIVISION, GREAT LAKES REGION; GEORGE ACRI, CHIEF, INDIANAPOLIS AIR ROUTE TRAFFIC CONTROL CENTER; NELSON LOCKE, AIRWAYS FACILITIES SERVICE MANAGER, INDIANAPOLIS ARTCC; BRUCE SELFON, OFFICE OF CHIEF COUNSEL, FAA; AND ALBERT B. RANDALL, OFFICE OF CHIEF COUNSEL, FAA**

Mr. SHARP. Mr. Chairman, I have a short prepared statement that might very well complement your opening statement, if I may proceed with it.

Mr. RANDALL. Certainly.

Mr. SHARP. At the outset, I would like to compliment you on the introduction of Congressman Evans, representing this district. We have had earlier discussions on this particular subject.

As you indicated, I am Warren C. Sharp, Director of the Airway Facilities Service of the Federal Aviation Administration. Appearing with me today are Mr. Kenneth Patterson, who is Assistant Chief of the Air Traffic Division of the Great Lakes Region in Chicago; Mr. George Acri, Chief of the Indianapolis Air Route Traffic Control Center, responsible for the air traffic functions there; Mr. Bruce Selfon, who is from the agency's chief counsel's office in Washington.

Mr. RANDALL. I want to say, if I may interrupt you, Mr. Sharp, that there is simply no way to proceed with the hearing without the presence of Mr. Selfon. He is a faithful follower of the group. We simply could not proceed without his presence.

Go ahead, sir.

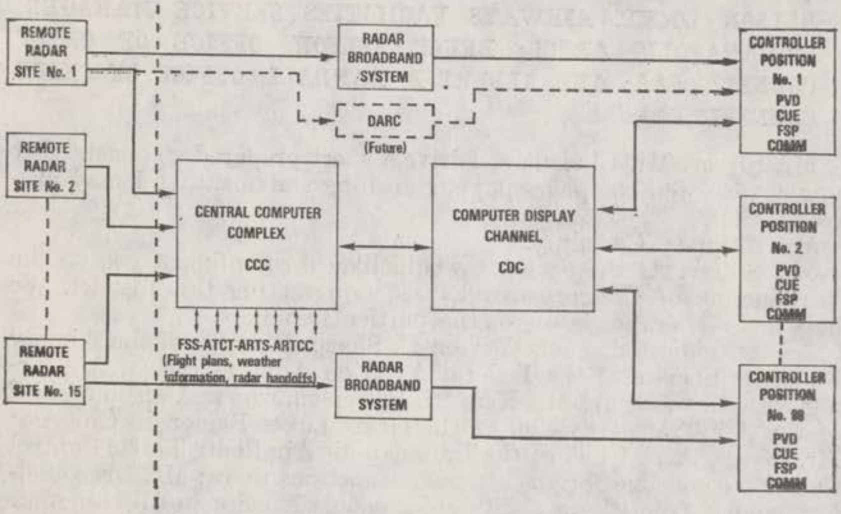
Mr. SHARP. On my immediate left is Mr. Gerald Thompson, of my staff, Chief of the Automation Engineering Division in the Washington office. Behind him is Mr. Bert Randall, also of the agency's chief counsel's office in Washington. And to his right is Mr. John Truhan, in the back row here, who is Chief of the Airway Facilities Division of the Great Lakes Region in Chicago. And at the corner of the table is Mr. Nelson Locke, who is Chief of the Airway Facilities Sector at the Indianapolis Center, having responsibility for the technical operation and maintenance of the Indianapolis Air Route Traffic Control Center system.

As you pointed out in your opening statement, the primary air traffic control system used in the 20 centers nationwide is in fact a technology intense, interrelated system comprised of radar, computers, visual displays, air/ground communications equipment, and the like. Since I believe it necessary to have a fundamental knowledge of the automated radar data processing system in order to understand system interruptions, I would like for Mr. Thompson to briefly discuss the system.

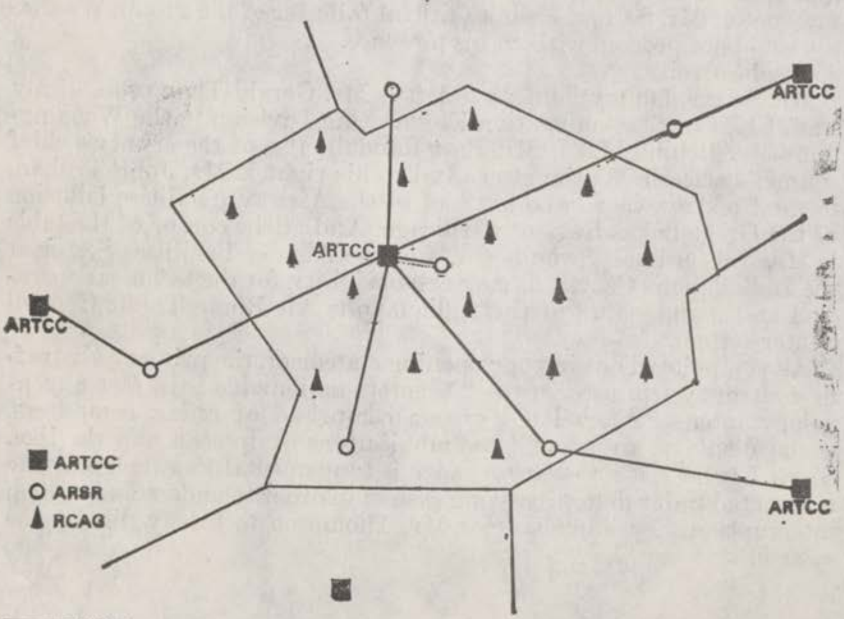
Mr. THOMPSON. Mr. Chairman, continental United States is divided into 20 areas, each having air traffic control centers.[1] This chart depicts the typical one as opposed to some specific one.

[The charts referred to follow:]

BLOCK DIAGRAM OF RADAR DATA PROCESSING SYSTEM




TYPICAL ARTCC FLIGHT ADVISORY AREA




[1] See app. 1.

Mr. Thompson. Associated with the air traffic control centers are long-range radars. They are represented on this chart by the circles. You will note in this case there are six, which may also be shared with an adjacent air route traffic control center. And their object is to give radar coverage of the entire flight advisory area. The triangles represent the RCAG's or remote communication air/ground facilities, where the communications with the pilot by radio are handled.

Mr. Randall. May I interrupt you, Mr. Thompson. What we are interested in I think is a map, the geography of this thing. In other words, what do you control here at Indianapolis. This information is welcome. But are you going to come up with a map directly? How many States does Indianapolis control here? How many States does Leesburg control? How many States does Chicago control—and so forth. Don't you have a map indicating that information? That would be much more helpful, give us some visual idea.

Mr. Thompson. I did not bring such a map.

Mr. Randall. All right. What is controlled here in Indianapolis? How far does it go? I understand it goes over to West Virginia a little bit, all of Ohio.[1]

Mr. Sharp. I think Mr. Acri is prepared to answer that.

Mr. Randall. All right. Go ahead. I thought you might give us a map.

Mr. Thompson. My goal is to show the system rather than the procedures.

Mr. Randall. All right.

Mr. Thompson. Each center then has from 4 to 11 radars feeding in. Indianapolis has five. And they are, one at Indianapolis immediately off the airport, one at London, Ohio, one at Nashville, Tenn., one at Lynch, Ky., and one at Oakdale, Pa., near Pittsburgh. In any case, you could have as many as 15 different radars feeding this center.

That radar information comes to the center in two forms. I will take it through the broadband system first.

From the radar site it comes in broadband form to the broadband system in the center. The data is then converted to a TV picture and a video map is overlaid on it. It is then presented to the plan view display that is used by the controller. We call it PVD. There may be as many as 90 PVD's in each center. Indianapolis has 33.

Each radar has an independent broadband set of equipment associated with it.

The other output from the radar site is in digital form. We digitize the information and transmit it to the air route traffic control center. The radar information is presented to the central computer complex. This is the IBM 9020 system.

In the central computer complex that radar information is put together with all the other radar information from other radars associated with the center, to form a mosaic or pseudo-radar that shows radar coverage of the whole area. With that mosaic, you first track those targets that the controllers have a need to track. Second, a determination of what information should be displayed at each one of the control positions is made. The information is then routed to the display channel.

There are two forms of display channels; Indianapolis has a computer display channel (CDC) built by Raytheon. Some other centers

[1] See app. 4 for map.

have a 9020–E, or display channel complex (DCC). That machine then takes the information to each planned view display.

One point here is that we currently have a contract to replace the broadband system with a system called DARC.

Mr. RANDALL. That is very interesting. There is going to be some more testimony on DARC after a while, isn't there? Are you going to be the witness?

Mr. THOMPSON. Among us, we will answer your questions.

Mr. RANDALL. We want to know about DARC. What does that stand for?

Mr. THOMPSON. Direct access radar channel.

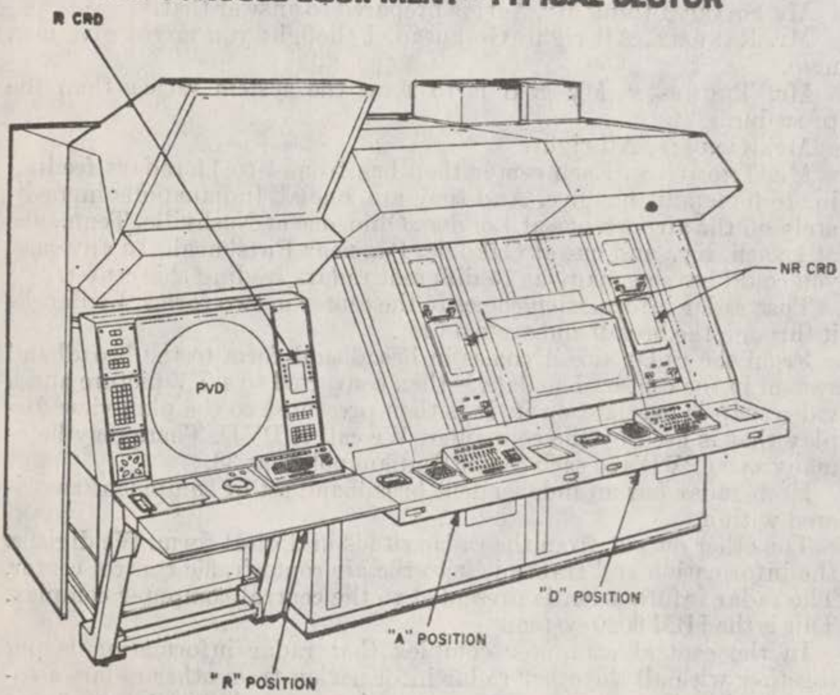
Mr. RANDALL. Thank you. Go ahead.

Mr. THOMPSON. DARC is a system that will use narrowband radar information and display it on a PVD. It will put up some alphanumeric information, but not as much as a 9020 and it does not do a tracking function that is done with the 9020.

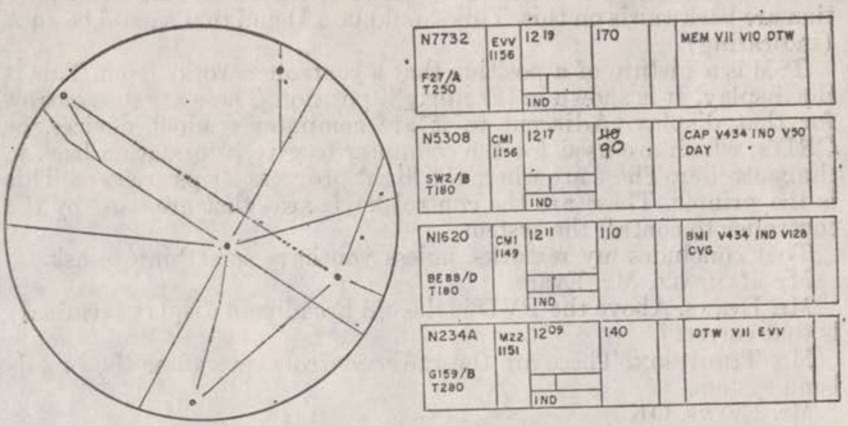
Now, this is a picture of a control position.

[The picture and relative material follow:]

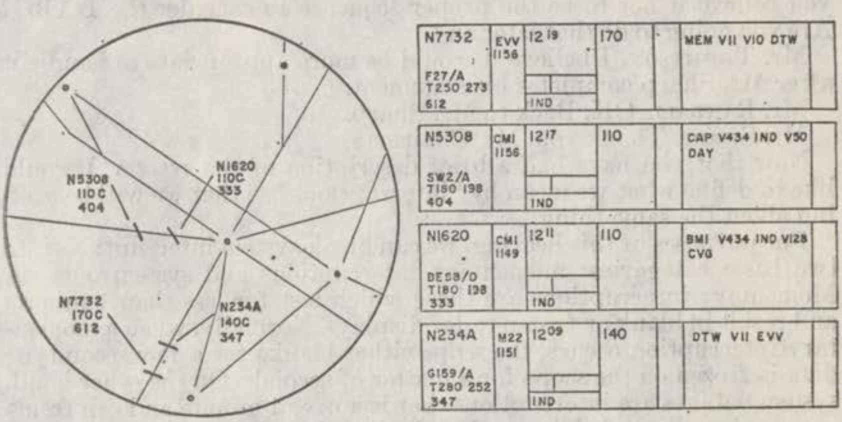
CDC CONSOLE EQUIPMENT - TYPICAL SECTOR



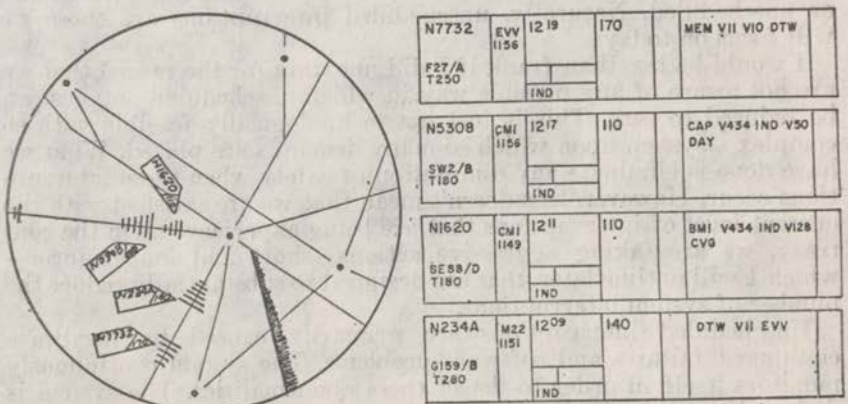
MANUAL CONTROL




NARROWBAND CONTROL




BROADBAND CONTROL



Mr. THOMPSON. I will first note that the A position and the D position are backwards on this. This should be a D and that should be an A (indicating).

This is a picture of a position that a controller works from. This is the display. It is shown in the upright position. These are the controls for that display. Adjacent to it are computer readout devices, or CRD's, which are used for the computer to give information back to the controller. These are where the flight progress strips are kept. This is the printer. These are the control keyboards that are used by the controller to control the system.

That concludes my remarks, unless you have something to ask.

Mr. RANDALL. Mr. Evans.

Mr. EVANS. Above the PVD is the old broadband display terminal; is that correct?

Mr. THOMPSON. These are the radio controls, as well as the broadband system.

Mr. EVANS. OK.

Mr. THOMPSON. The picture for the broadband comes on the PVD.

Mr. RANDALL. Mr. Thompson, are you prepared at this time or do you believe it not to be the proper sequence to consider the DARC? Are you going to do that later on?

Mr. THOMPSON. I believe it would be more appropriate to handle it after Mr. Sharp completes his statement.

Mr. RANDALL. OK. Back to Mr. Sharp.

Mr. SHARP. Thank you, Mr. Chairman.

Now that you have had a brief description of the system, I would like to define what we mean by "interruptions" so that we will be talking about the same thing.

For purposes of this hearing, we can break system interruptions into two basic categories: momentary interruptions and system outages. Momentary interruptions are those which last for less than 1 minute and result in blank or frozen radar displays. Normally, when a momentary interruption occurs, the scope either blanks for a few seconds or data is frozen on the scope for a matter of seconds. On the other hand, system outages are interruptions that last over 1 minute and can result in complete loss of data to the visual radar displays. In this case, broadband radar display is available for use.

System interruptions occur in all centers and can be either scheduled or unscheduled. Naturally, unscheduled interruptions are those we will focus on today.

I would be less than frank if I did not state for the record that we are not aware of any possible way in which unscheduled outages can be reduced to zero. This is just not technologically feasible with so complex a system upon which so many demands are placed. What we have done is eliminate any diminution of safety when these interruptions occur. However, this doesn't mean that we are satisfied with the current level of interruptions that are being experienced. On the contrary, we are taking aggressive actions—short and longer term—which I will outline later, that are designed to substantially reduce the number of system interruptions.

Unscheduled interruptions are primarily caused by hardware equipment failures and software problems. The system continuously monitors itself in order to detect these abnormalities. The system is designed to prevent presentation of erroneous data to the controller.

Consequently, when the system detects erroneous data which could mislead the controller, it results in correction of that data with no interruptions or it flushes that data from the system by inducing a startover. In a startover, the system analyzes the problem, corrects the problem, recovers, and presents the correct data to the controller. Startovers normally require less than 10 seconds but, dependent on the problem which needs to be corrected, may exceed this time frame. Rarely would a startover reach the status of an outage, which for our purposes has been defined as 1 minute or longer.

In some instances, the system attempts to start over but is unable to correct itself. This would then require manual intervention to correct the problem. Most often this would result in an outage.

A point I would like to emphasize here is that a startover is itself a beneficial aspect of the system since it (1) corrects erroneous data and (2) reduces the length of time that would otherwise result from manual intervention to correct the problem. From the standpoint that it is not technologically possible to reduce errors to zero, startovers, while sometimes aggravating, do avoid the adverse consequences that could otherwise arise from presenting erroneous data to the controller.

Allegations have been made that system interruptions pose a hazard to aviation safety. This is not the case. While to those unversed in the air traffic system interruptions might raise concerns about safety, in reality the system, itself, as well as air traffic procedures, are designed to accommodate interruptions without derogating safety.

As I previously stated, momentary interruptions generally last only for a few seconds. In this connection, I should note that radar data shown on a controller's display is updated every 10 to 12 seconds. The effect of a momentary interruption is therefore negligible. The concerns with momentary interruptions then are essentially that (1) they are a source of aggravation to the controller which, if unchecked, could damage system credibility, (2) an increasing number of momentary interruptions is generally a prelude to increased system outages, and (3) they signify errors within the system that should be corrected.

System outages last longer than momentary interruptions and therefore require different actions than momentary interruptions. When a system outage occurs, the controller switches to broadband radar—our backup system—to continue tracking or controlling the aircraft he is concerned with. Broadband radar was the system used in all centers until 1974, when we began switching to our present radar data processing system. There is nothing hazardous in our use of broadband radar; in fact, this is the system used by controllers during those hours of the day when our primary system is undergoing maintenance, or certification.

If broadband radar were to fail we still have another backup system available to control traffic. This is achieved through the use of flight progress strips, which results in manual control of aircraft. Manual control is the most basic form of air traffic control that we use and was the only system available for use prior to the introduction of broadband radar.

Mr. Randall. Mr. Sharp, I don't want to interrupt because I know it is a bad procedure. But maybe you can clarify this for a lot of us. Up to this point you have said, along with the other witness, that there are four types of controls. You start out with the new RDP as the most

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sophisticated. Then you come down to one which is maybe not quite as sophisticated but appears, from the information we have been able to glean, reliable, and that is DARC. Then you come back down and the next would be broadband. Maybe there are five. There is your narrowband, to start with; then your modification of that, which I assume would be DARC. Then you come down to broadband. Then you get back to the older system. These are all fallbacks or backups. Isn't that right? You are really talking about four systems, am I right?

Mr. SHARP. Yes, sir. Except that DARC is not yet in operation.

Mr. RANDALL. We understand that. But it is hopefully a breath of fresh air and a ray of sunshine after what we see about RDP here. We might be a little rough with you on RDP, because we think there are a lot of bugs in it. We are going to try to find out this morning. But now we are talking about four, aren't we?

Mr. SHARP. Mr. Chairman, I think basically there are three.

Mr. RANDALL. What are they?

Mr. SHARP. The RDP, or the narrowband system, the broadband system, and the basic manual system.

Mr. RANDALL. In other words, you are saying DARC is part of the narrowband.

Mr. SHARP. DARC will replace the broadband system, that is the current second fallback position.

Mr. RANDALL. I think we ought to nail that down.

Mr. EVANS. Is broadband still going to continue to be used after the introduction of the DARC in the future, or will it just be completely eliminated?

Mr. SHARP. The broadband system will be completely eliminated. There will be, of course, a changeover period. We are planning a minimum of 6 months at each center location wherein the broadband information will be replaced as the backup tool of the air traffic controller with the DARC system, which will provide a display in an operation more nearly like the RDP or narrowband system now provides.

Mr. EVANS. I see. So now we have the narrowband, the broadband, and then the manual control. In the future, a few years off, we will have the narrowband, the DARC and the manual control.

Mr. SHARP. Yes, sir.

Mr. EVANS. I see.

Mr. RANDALL. Thank you very much, sir.

Mr. SHARP. The basic impact of using broadband radar rather than RDP or manual control rather than broadband is a loss of efficiency in the system. RDP has a number of automatic features which free the controller from performing tasks required with broadband. Therefore delays may occur when broadband is used rather than RDP. Similarly, broadband is significantly more efficient than manual control of traffic. For one thing, manual control dictates substantially greater separation standards between aircraft than does broadband or RDP for which separation standards are essentially the same. By imposing greater standards for separation, the impact is inconvenience in the form of delays caused by less efficiency in the system.

The central point is that various contingencies which might arise have been previously considered and have been accommodated by system design and air traffic procedures to prevent the derogation of aviation safety.

I would like to turn briefly to Mr. Kenneth Patterson for a more in-depth discussion of the air traffic control consideration.

Mr. RANDALL. He is from over in Great Lakes region.

Mr. SHARP. Yes, sir. He is the assistant chief, air traffic division chief in the Great Lakes region, headquartered in Chicago.

Mr. RANDALL. Before he begins, I want to determine where Mr. Patterson stands in the chain of command. Is the Great Lakes region over some of these air route centers? And how many centers does he have? He is one of your lieutenants, in other words, one of your regional men, is that right?

Mr. SHARP. Yes. Mr. Patterson is a regional employee. He happens to be involved with the Air Traffic Service that is not under my direct jurisdiction or responsibility.

Mr. RANDALL. He is over in this other part. You are facilities and he is traffic control.

Mr. SHARP. Yes, sir. And the Great Lakes region has jurisdiction over four centers, which would include Indianapolis, Chicago, Minneapolis, and Cleveland.

Mr. RANDALL. Thank you.

Proceed, sir.

Mr. PATTERSON. Thank you, Mr. Chairman.

I would like to present a simplistic overview of what the controller sees under the three systems we have discussed that are in operation today.

As you are well aware, the air traffic system has evolved over the past 30 years and has indeed become more complex and has indeed become quite a lot larger. But in order to see what the controller sees—and again it is in a very simple form—under these three systems, I would like to start with those three we still have with us today and are actually using today.

For the purposes of this demonstration, this will be a map of the first viewgraph. These are airways, which are very similar to highways in the sky, which aircraft traverse to and from different points. We will consider the point in the middle of Indianapolis. Under the manual system, the controller primarily uses his flight progress strips for all data-keeping purposes. He has direct radio communications with the pilot and interphone capabilities between facilities, and keeps the aircraft apart by either 10 minutes or 1,000 feet below 29,000 and 2,000 feet above 29,000. Those are the separation standards.

On the flight progress strip, he has several pieces of information: the aircraft identification, type of aircraft, the speed, his estimate over the last fix or geographical point outside his sector of jurisdiction usually, and an estimate over a primary fix within his sector, which in this case will be Indianapolis, where he could keep track of whether or not he had that 10 minutes that he required based on pilot reports, altitude, and a route of flight.

As you can see in this example—and it is very over-simplified example—the two aircraft in the center were both at one time at 11,000. We dropped the last two zeros in the altitude. And since he did not have 10 minutes between them on the same route, a previous controller or this controller had to change the altitude and put this one at 9,000.

Next I would like to show you basically what the controller sees with the broadband display.

First of all, he now has radar and he can actually see the aircraft, so he now has more capability for efficient use of the airspace. The separation standards altitude-wise remain the same. However, he now can keep the aircraft 3 to 5 miles apart, depending on their proximity to the main antenna, which I have depicted right here. The controller now keeps track of the aircraft by writing the aircraft identification and altitude on a clear plastic marker which he pushes along his display following the aircraft.

Mr. RANDALL. You call those shrimp boats?

Mr. PATTERSON. Shrimp boats, pucks, pips. I think they call them pips here at Indianapolis.

Mr. RANDALL. OK. Thank you.

Mr. PATTERSON. Again, he has his flight progress strips, which he continually keeps updated, just as he did with the old manual system.

In this example, we can see he kept the two at 11,000 because he had at least 5 miles separation between those two at the same airspeed, making a much more efficient use of the air space available to him.

Mr. RANDALL. Mr. Patterson, you have used the word "see," that he can see the aircraft. Obviously your radar is not efficient enough here at this place, you must have some remote feed-ins. How many of those do you have? Who is seeing this? The information is brought to you electronically here?

Mr. PATTERSON. Yes.

Mr. RANDALL. How many remote stations would you have, for instance, out of Indianapolis?

Mr. PATTERSON. I believe Indianapolis has five, sir. Each facility has——

Mr. RANDALL. Those are the ones enumerated a while ago—Kentucky, Pennsylvania, and so forth?

Mr. PATTERSON. Right. Indianapolis has five. Each facility has a different number, depending upon the area of coverage, and how good the coverage is. These broadband radars are piped in by a data link from their remote locations.

Mr. RANDALL. Those are your eyes. But how good are those eyes? What is the range?

Mr. PATTERSON. Each one has a 200-mile radius, sir.

Mr. RANDALL. Thank you. Mr. Evans.

Mr. EVANS. I would like to get a copy of the prior display that you had there on the screen. My copy is not properly identified. Well, I guess due to technological problems, we are not able to have a copy. OK.

Mr. RANDALL. Well, surely the FAA, with all of its self-acknowledged efficiency, can give us some maps here, can't they, that we can understand. Is this any better? Does this help you?

Mr. EVANS. OK. Go ahead.

Mr. PATTERSON. The benefits derived from the radar data processing system over the broadband system are, No. 1, there is a decrease in radio communications requirements between the controller and the pilot, because he now has the altitude data displayed on his scope, and if the aircraft is equipped with mode C or altitude reporting capabilities, he no longer has the house-cleaning chores of updating the plastic shrimp boats or pucks, because the aircraft identification is displayed on the display.

And this last one is the computer identification number for each aircraft. Notice again the controller still has the same flight progress strips which he keeps updated continuously.

Mr. EVANS. Excuse me. He is updating these strips himself, writing out the information periodically?

Mr. PATTERSON. The controller team, either himself or his tracker, or his manual controller is, yes—depending upon the traffic situation, the number of people at the sector. Yes, he does.

Mr. EVANS. OK.

Mr. PATTERSON. OK.

Another benefit of the radar data processing system along with the fact that he does not have the house-cleaning chores with the shrimp boats—and he now has the altitude readout capability, and he no longer has to push the plastic markers along—is the fact that he no longer has quite the coordination problems that he used to have insofar as making transfers of control between one sector or another facility. That is now done automatically.

Since we are talking about outages, I would like to go backward in this display and show what happens, or what he sees, as we evolve towards RDP, what he has to do when he goes backward. We will go back to the second slide.

First of all, in the previous sector chart that Mr. Thompson had, you saw the scope was in a vertical position or upright. The controller has immediate access by a button to this display of broadband. He does not have the shrimp boats, et cetera. When he decides he has to go to broadband for an undetermined length of time, he then puts the scope into a horizontal mode, picks up the shrimp boats, and, as I said before, the separation standards are the same or virtually the same between radar data processing and broadband.

Of course, if both went out, he would have to go back to the old manual method of control, which is basically altitude and time. And in this case he would have to make a decision and put those two aircraft at different altitudes.

That completes my oversimplified view of what the three systems that make up our total en route system are today.

Mr. RANDALL. Before you retire, please, Mr. Patterson—the Chair finally got hold of a map here that shows the zigzag lines of the area, the end route center of Indianapolis.[1] And without any help at all, we find that there is one feed-in, remote control, down here, from some unidentified place down near Memphis, way down South, somewhere in that area.

Then we go on over here and it looks like somewhere in the Atlanta area, very near your zigzag line. And that would be No. 2. I just want to see if we are right. Is that substantially right? In other words, there is one down in Tennessee around Memphis. I am talking about the ears and the eyes that bring you this information. That is what we are talking about. There is one down around Memphis, one around Atlanta.

Mr. SHARP. Mr. Chairman, may I ask Mr. Locke to present that information.

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[1] See app. 4.

Mr. LOCKE. The one down near Memphis is Nashville, Tenn. That is a radar that jointly serves the Memphis Control Center and the Indianapolis Control Center. I assume the one to the southeast that you are referring to is Lynch, Ky.

Mr. RANDALL. It is here on the map—an asterisk very close to Atlanta. But we will call it Lynch, Ky.

Mr. LOCKE. Lynch, Ky. This is within a few miles of the boundary, the nearest town being Big Stone Gap, Va., the Kentucky-Virginia boundary. That center, or that radar serves both Atlanta and Indianapolis.

Mr. EVANS. So each one of these radars is serving more than one area of coverage.

Mr. LOCKE. Not every one. These two particular ones have this feature.

Mr. RANDALL. I see No. 3—somewhere between Pittsburgh and Cleveland, clear out of your area.

Mr. LOCKE. Just west of Pittsburgh—Oakdale, Pa.

Mr. RANDALL. That is a situation like you had down there at Virginia and Kentucky, around there, that serves both. You have an en route center at Cleveland, I assume.

Mr. LOCKE. At Cleveland, yes, sir. That is Oakdale, Pa., which serves both Cleveland and Indianapolis.

Mr. RANDALL. OK. And then Ohio?

Mr. LOCKE. Centrally located in Ohio. It is approximately 45 miles west of Columbus. That is London, Ohio. That one serves both Cleveland and Indianapolis.

Then locally here we have a radar within a half-mile of the airport itself, and that serves only Indianapolis.

Mr. RANDALL. It is not quite an accurate statement to say that it serves Indianapolis only. It is not like a terminal tower of any kind.

Mr. LOCKE. I am referring to the center.

Mr. RANDALL. You are referring to the 200-mile radius that these are supposed to pick up.

Mr. LOCKE. That is covering a large geography. The Indianapolis radar would cover north beyond Lafayette, and a rather large geography in that area.

Mr. RANDALL. OK. Mr. Sharp.

Mr. SHARP. Mr. Chairman, I apologize for the quality of some of the maps we have presented. I will be pleased to provide higher quality data for the record, if I may, sir.

Mr. RANDALL. All right. Thank you.

Mr. SHARP. I would like, if I may, sir, to continue with my statement.

Mr. RANDALL. All right, go ahead. Some of us have been in the People's Republic of China, had that privilege, during the Easter recess; and we find they have maps very similar to this.

Go ahead.

Mr. SHARP. As stated earlier, the FAA is taking affirmative steps to lower the number of errors that occur within the system in order to reduce system interruptions. We have increased the emphasis on reducing system interruptions and will continue to stress management awareness of the problem. For example, in July 1976, teams of engineers investigated problems at three centers, including Indianapolis. As a result of this investigation, one change in power input equipment has already been made and additional modifications to the hardware have been installed in all 20 centers.

Mr. Thompson recently chaired a 3-day conference of sector managers at our National Aviation Facilities Experimental Center at Atlantic City, N.J., in order to take a critical look at system interruptions and the actions necessary to reduce them. Through sessions such as this, we hope to be able to approach the problem in a manner consistent with regional concerns and with key input from regional personnel.

We have implemented a new reporting scheme to track interruptions and to provide a better management information vehicle for followup corrective actions. We have also initiated procurement of additional test equipment for improved troubleshooting of the system. This equipment should be available by the end of the year. Moreover, a group of headquarters and regional representatives is being formed to categorize and track outages through to their resolution.

In the short term, we believe that the best payoff will result from increased management emphasis on maintenance of the system. I want to stress that I don't believe that we have done a bad job in this area. Rather, I think that as an agency we can do better.

We intend to provide our facilities with improved test equipment in the next couple of years and improved diagnostic software will be provided in 1978. We plan to supplement our present troubleshooting team from headquarters with additional teams, possibly located in the regions. We are also looking at ways to improve technician proficiency through appropriate revisions in agency training practices.

Improved lightning and surge protection should be installed at all centers before the 1978 lightning season.

Mr. RANDALL. What do you mean by surge protection? I guess we know what lightning is. You are talking about natural lightning. What is surge protection?

Mr. SHARP. Lightning storms—and Indianapolis is one area where they are relatively intense—have an effect on power distribution systems when they either strike the system or at points near the system that cause the power, the voltage on the system to increase drastically in magnitude.

Mr. RANDALL. In other words, lightning off somewhere is going to give a big push on your power and blow up the whole business. The surge will knock the computer out.

Mr. SHARP. Yes, sir, that is a fair assessment of the situation. Our intent is to provide additional surge protection. There is surge protection on all power distribution systems. But we have found it not to be adequate for the quality of power that we feel we need to maintain in the system. Therefore, we plan to provide for additional surge protection of our electrical distribution system.

Mr. RANDALL. Thank you.

Mr. SHARP. Improved electrical grounding, bonding, and shielding guidelines should be available in draft form by the end of 1976. These actions will result in reduced outages induced by power input problems, that is, the lightning problem.

We are exploring all avenues in our attempt to reduce system interruptions. We believe that we can improve our track record and we intend to do just that. I want to emphasize again, however, that the complexity of the system, and the interdependency of the components of the system, do not lend themselves to simplistic solutions. The bases on which an error can enter the system or be generated within the system are almost without limits.

Unless great care is taken when resolving specific errors, new errors may be induced creating a necessity to identify their causes and to develop actions necessary to resolve them.

We have discussed some of the problems we experience with the RDP system. I would like to close with a different tack. This system is the best system in use in the world. We are proud of this system and of its capabilities. Nevertheless, there are ways system performance can be improved and we are aggressively taking the steps necessary to do that. I don't want to ignore one last ingredient in the formula—the professional quality of our air traffic controllers who have demonstrated their capability to cope with equipment problems and do their job well.

Mr. Chairman, that concludes my prepared statement. My associates and I will be pleased to answer questions that you or members of your subcommittee may have.

Mr. RANDALL. Thank you, Mr. Sharp.

Going from the last to the first, right at the end of your statement, you paid a compliment to the controllers. And I think that is well and good. But you also made the comment that whatever is wrong with the system, whatever shortcomings, deficiencies, omissions, failures, that it may have, it is still the best in the world. So my question to you is—there is a book out now that has just been published in the last week or two, and I have forgotten its exact title, which has to do with the terrible DC–10 crash in which a cargo door blew out on a flight out of Orly Airport near Paris, back in 1974. Then we had the very horrible air collision recently somewhere in Yugoslavia. Are you saying to us if they had this system over there, that we have here, it might have been avoided? Of course, I don't know whether you can avoid a door blowing off. But you say that the system in Europe is not as good as ours?

Mr. SHARP. It would be, Mr. Chairman, impossible for me to say that if they had our system, that the midair collision in Yugoslavia would not have occurred. However, we are aware of the European system. My colleague, Mr. Thompson, has some knowledge of it. And we feel that our system is clearly superior to that system being utilized in Europe.

Would you care to comment on that, Mr. Thompson?

Mr. THOMPSON. I don't have any particular comment.

Mr. RANDALL. Go ahead, sir. Just tell us straight up and down, any other way you think, why we have the best. The other is just not equal to ours?

Mr. THOMPSON. They do not have the coverage as we do. They do not have the machines we have. The only one comparable in any way to ours that I know of is that which is used by Euro-control in the Netherlands.

Mr. RANDALL. Thank you.

Now back to Mr. Sharp, please.

You told us a lot on page 4 of your statement, which is probably the best page of your testimony, or the worst, depending upon how you look at it. You said there at the top of page 4: "Allegations have been made that system interruptions pose a hazard to aviation safety. This is simply not the case. While to those unversed in the air traffic system, interruptions might raise concerns about safety, in reality the system itself as well as air traffic procedures are designed to accommodate interruptions without derogating safety."

How can you tell us, Mr. Sharp, when the system goes out that it does not affect safety? How can you stand on a statement like that?

Mr. SHARP. First of all, Mr. Chairman, the system is composed basically of two elements—the machines and the people who operate them. The air traffic control system is designed so that these two elements complement each other, and the control systems utilized by the personnel are so designed that there should not be conflicts in traffic occurring and, when an interruption occurs, there is time, with the backup systems, to reconstruct the control situation and avoid unsafe situations occurring.

Mr. RANDALL. Well, we are going to hear from the controllers after a while. But that is the very point they are trying to make; that they go into a state of anxiety, a state of uncertainty, depending upon the seconds ticking away, whether it goes up beyond that minute or not. They are getting mighty anxious and mighty nervous. They know they are going to have to do something.

You have said that machines and men complement each other. But that is the time it would seem that we are getting involved with some safety considerations. In other words, they are going to have to make a decision whether or not they are going over to the other backups. And the longer those seconds tick off, the worse things are getting, because planes are moving mighty fast, aren't they?

Mr. SHARP. Yes, sir; they are. And I would point out that to bring up the backup system requires merely the push of a button on the control display.

Mr. RANDALL. Just a moment. We are going to go out there tomorrow. But we understand from those who have been out there that you have to pull down something that is pretty heavy. Sometimes it is stuck. Sometimes you cannot quite pull it down, and you struggle around with it. Somebody was out there Sunday or Monday and could not pull one down at all. Isn't that true?

Mr. SHARP. That does occasionally happen. I think perhaps we need to define the terms. To convert completely from a narrowband or automated operation to a broadband control situation does require greater than 1 or 10 seconds. However, by the push of a button the broadband data can and does come up immediately, and is available to the controller for review of target positions. To convert to the broadband operation, he would then put the scope into the horizontal position, and, during the time, of course, it is being lowered in horizontal position, he can still see the target data. Then, of course, the control group has to prepare the shrimp boats or pips to convert to the full broadband operation.

Mr. RANDALL. Mr. Sharp, on page 5 you say the whole thing over again. "If broadband radar were to fail, we still have another backup system available to control traffic." You say that it is all designed to prevent derogation of aviation safety. But aren't you writing in a premise that may not exist there, that this relationship that has been talked about between, I think you called it, machines and people, during a busy period—if you have ever been to JFK Airport, the control out there that handles LaGuardia, JFK, and Newark; those fellows are simply climbing the walls sometimes Sunday night, between 5 and 7 o'clock, for example. That is the worst. That is the worst you can get anywhere in the world, I guess. So I don't know how you can say what you say on page 5. This switchover during the busy period is really dangerous. You cannot say it is safe, because it is not. And what you are talking about here is virtually the same thing which we hammered at pretty hard back in the Carleton near midair collision, where one fellow got up and left and the other fellow came in and saw it just in time to prevent that collision in the air. Those seconds are pretty precious there. During the busy period it is a pretty bad thing when these things go out.

I am not trying to put words in your mouth. If you want to respond to that, all right.

Mr. SHARP. Well, Mr. Chairman, we will certainly agree that the failures are clearly aggravations to the controller, and that there doubtless would be some anxious moments while reestablishing control in the broadband mode.

I would defer to my colleagues with respect to the air traffic, the direct basic air traffic control procedures. If the air traffic control, the flow of traffic has been set up in accordance with the procedures, there should be separation between all aircraft that would not derogate in a matter of 10 or 15 or 20 seconds, or perhaps even a minute.

Mr. RANDALL. What you are saying to us is there is nothing to worry about in this minute you are talking about.

Mr. SHARP. I don't believe I said——

Mr. RANDALL. You said there is enough separation that you don't have to worry about that minute.

Mr. SHARP. Yes, sir.

Mr. RANDALL. But there wasn't enough separation at Carleton, was there?

Mr. SHARP. I would defer to my colleague, Mr. Patterson, on that.

Mr. RANDALL. There wasn't enough separation there in those precious seconds.

Mr. SHARP. I would defer to my colleague, Mr. Patterson.

Mr. RANDALL. All right. Then I will yield to Mr. Evans.

Mr. PATTERSON. I would like to start with the example of Indianapolis on June 29, where it went all the way back to having to go to the manual system and then some, for that matter. There were 109 aircraft actively in the air within the Indianapolis center's area of responsibility. Of those——

Mr. RANDALL. Mr. Patterson, why do you pick that date? Is that when the lightning hit?

Mr. PATTERSON. Yes, sir.

Mr. RANDALL. June 29. How many aircraft were in the air?

Mr. PATTERSON. 109 within the Indianapolis area of responsibility.

Mr. RANDALL. Thank you.

Mr. PATTERSON. Of those, three were in potential confliction with each other. And then another two in another part of the facility were also in potential confliction. And we were required to issue three clearances to establish positive separation between those five aircraft. And although I would say that there certainly is a need for concern and a need for dramatically paying attention during an interruption or a failure, our system is built so that, and our controllers are trained and skilled enough that they can revert to either the broadband method of separation, or if necessary the manual method of separation.

Mr. RANDALL. We will get into that in a little while, about how skilled they are and what kind of supervision they have as far as the supervisor is concerned.

All right. Mr. Evans.

Mr. EVANS. Mr. Sharp, when these system interruptions occur, I presume that you would agree that this does affect the air traffic controllers, it damages the credibility in the system. Doesn't this have an effect on operations, on safety—the controller's degree of reliability, credibility, that he gives to this system?

Mr. SHARP. Mr. Evans, I would like to respond to that question by saying, yes, we agree, except—and recognize that the failure, the interruptions are an aggravation to the controller, and that if repeated with sufficient frequency they clearly destroy the credibility of the system and his confidence in it. And therefore, we the technical arm of the agency, who have the responsibility for the technical operation and maintenance of the system, do concern ourselves with that aspect.

With respect to the controllers, any derogation of the controller's efficiency in this situation, I would again like to defer to my colleague, Mr. Patterson.

Mr. EVANS. If I could get an answer there—does that or does that not then affect the safety of the operation of the system?

Mr. SHARP. We feel that it does not, with the proper application of the air traffic control procedures as developed and intended to be applied—that it does not in fact affect the safety of the system to revert to a lesser, if we consider broadband to be a lesser capability system, as it is. So we feel that it does not derogate safety.

In terms of controller efficiency, I would prefer to defer to my colleague who supervises that group.

Mr. PATTERSON. Mr. Evans, I think that it certainly is irritating and certainly is undesirable to have to convert to any other system. I think what is derogated is the efficiency of the system and our total capability to handle the numbers and volume of aircraft that we do. As far as safety, I do not believe that it is unsafe, and in fact have researched our errors in the past and have had no indication that that is the case, during an interruption.

Mr. EVANS. You are indicating, then, in effect that the relationship between—and I think you had mentioned this, Mr. Sharp, earlier—the people and machines complementing one another—that relationship remains the same, then, even during time periods when you have to switch to the broadband.

Mr. PATTERSON. I don't think it remains exactly the same. I think certainly the controller gets irritated when any of his equipment goes out. I think the point that we were trying to make there is that the separation standards remain the same. There are certain other duties or different duties that the controller now has to perform that he wouldn't have had to perform, and in that way, of course, it is an irritant.

Mr. EVANS. I see. Would you say there is more of a chance for errors, problems developing, under the broadband control, then, than under normal operations, under the narrowband?

Mr. PATTERSON. No, sir.

Mr. EVANS. You would not.

Mr. PATTERSON. No, sir.

Mr. EVANS. Mr. Sharp, going back to your statement for a moment here, I believe in your statement you indicate concern about these outages. On the other hand, as we said here, and I think is quoted somewhere in here, you had pretty well eliminated any diminution of safety when these interruptions occur.

Let me just finalize this area for a moment, then, by saying you are stating that the system efficiency is not lowered. Is that a correct statement, in your opinion?

Mr. SHARP. No, sir. I hope I did not make that statement. The system efficiency is lowered with these interruptions—it clearly lowers the efficiency of the system, because we are unable to handle the same quantities of traffic with a reduced level of technical operation that we can with the full capability. So the system efficiency is in fact lowered.

Mr. EVANS. I would like to move to another area for a moment.

This subcommittee has received various documents showing numbers of interruptions and outages at these various centers. It is somewhat difficult, I think, to get a full and accurate picture of what we are talking about in terms of numbers, types of interruptions, outages and so forth, from many of these documents that I have looked at. And I think we made reference to this earlier, that various centers appear to be using different reporting methods, different criteria, even.

I think you said some steps were being taken to correct that. But I wonder what specifically is being done to assure a more uniform reporting of these interruptions and outages at centers throughout the United States.

Mr. SHARP. Mr. Evans, a couple of comments, and then I will ask my colleague, Mr. Thompson, to make a comment or two.

As we pointed out in the statement, we are discussing here two types of outages—momentary interruptions and system outages.

Mr. EVANS. Right.

Mr. SHARP. System outages are defined as 1 minute or more and their reporting is provided for in a national reporting system.

Mr. EVANS. Who has established the definition of what is an outage and what is an interruption? Is that the FAA's definition?

Mr. SHARP. It is the FAA's definition. Basically, the establishment of system outages and interruptions came about from the engineering need for data to work with. So over the last 6 or 7 years, system outages, of any element of the system, whether it be a radar center, an instrument landing system, et cetera, have been reported in increments of 1 minute or more.

Mr. EVANS. All right. That definition has been in effect, then, for——

Mr. SHARP. Six or seven years. And incidentally, prior to that time only outages of 6 minutes or more were reported.

Mr. EVANS. OK. Perhaps, Mr. Thompson, could you tell us specifically what is being done to insure that we are receiving uniform reporting currently and will in the future from centers throughout the United States?

Mr. THOMPSON. We first do not intend to change the reporting system for 1 minute or more. That will continue as under the current system. Second, we have issued an order to all facilities that they will report all interruptions to the computer system in their facility.

Mr. EVANS. They will report them to FAA and Washington?

Mr. THOMPSON. Yes, sir, and the region.

Mr. EVANS. And their region.

Mr. THOMPSON. Right. All interruptions, regardless of the time. They will do it by class, meaning what particular system element was involved, whether they were scheduled or unscheduled, and general remarks of what the causes were.

Mr. RANDALL. Would the gentleman yield?

Mr. EVANS. Yes, certainly.

Mr. RANDALL. Have we just stumbled on what may be a valid reason for your arbitrary classification of 1 minute? Is it possible that it takes a minute for that radar to turn around? Is that the reason?

Mr. THOMPSON. It takes the radar 10 to 12 seconds.

Mr. RANDALL. That is why you start on your minute, then, is that right?

Mr. SHARP. Mr. Chairman, may I comment. The minute time frame as I pointed out and mentioned earlier, up to and through the sixties, or at least until the late sixties, we used a 6-minute reporting increment. The minute was derived from——

Mr. RANDALL. Now you are getting down to what we are asking you. Where did you get the minute?

Mr. SHARP. The minute was derived from an expectation and understanding of the length of outage that would cause some disruption of the system. And as I pointed out, we found out, when aircraft were slower and less voluminous, of less density, 6 minutes seemed to be adequate. In the late sixties or perhaps as late as 1970, we redefined an outage to 1 minute, because based on the collective judgment of agency management, this length of outage would be that that would impact on the system.

Mr. RANDALL. We try to help you, but it doesn't look like you want us to help you. You are still setting up the minute as something arbitrary. Do you fudge a little bit on some of these reports? Mr. Evans is going to have some more questions about reports. But if it is a minute and 3 or 4 seconds, do you call it an outage?

Mr. SHARP. Yes, sir, that is a system outage.

Mr. RANDALL. All right. Some of us can remember the oil embargo. We found at that time one of the greatest embargoes on earth was an embargo of information. We didn't know how much we had in the pipeline, how much in tanks, how much in anything.

Now we are trying to find something here in terms of information on this reporting service. We want to know how serious this thing is nationwide as well as here in Indianapolis. And that is why these questions are being propounded to you on this reporting system.

Mr. SHARP. Mr. Chairman, if I may add one more point.

Mr. RANDALL. Go ahead.

Mr. SHARP. With the inception of the automated system, for the first year or so we did track the momentary interruptions, and for reasons of priority of attention, we moved away from that. But based on the concern expressed here at Indianapolis as well as some other locations, in mid-July it became clear to us that the 1-minute outage time was not adequate to define the impact of system interruptions or momentary interruptions on the control system. Therefore, we have initiated the requirement to report outages of any duration in order to be able to better assess——

Mr. RANDALL. Mr. Sharp, I think you can understand why we are asking these questions. Do we rely on the very stinging indictment by the lady who wrote the article, or are we going to say your reporting is accurate or not? We will get around to these questions later. All right, Mr. Evans.

Mr. EVANS. To get back to my original question, then—you are going to make sure that all interruptions are reported and that will be it for the future, is that correct?

Mr. THOMPSON. That is the intent, sir.

Mr. SHARP. Yes, sir, that is our intent. I don't know how we can get below any interruption. But that is our intent. And that is——

Mr. EVANS. At least we are going to have much better data, reports that we are going to be able to compare with one another, and they are going to have the same type of information on them.

Mr. SHARP. Yes, sir, that is our intent, and we believe we will have that. We already have the data coming in.

Mr. EVANS. I wanted to ask a question, Mr. Sharp, as to whether in your opinion the problems that we have experienced here in Indianapolis—I think the period of time we are talking about is early June to mid-July, many of the interruptions and outages occurred during that time—would you say that this is about average with the rest of the country, or was there a problem particularly here in Indianapolis? What would be your comment?

Mr. SHARP. Mr. Evans, I would have to answer that question in two parts. One, of course the total outage of the facility on June 29 is not representative——

Mr. EVANS. I don't mean specifically that. I am talking more about the period June 1–July 10.

Mr. SHARP. There were, as a result of that outage, a number of follow-on outages, because the power conditioning system was not available for some 13 days. There were some additional outages induced because of power line irregularities that normally would have been corrected. I believe there were seven of those. Except for those periods, and some of the induced outages resulting from the lightning strike, we feel that the Indianapolis center is approximately comparable to the performance in the rest of the country, the rest of the centers of like nature.

Mr. EVANS. You are talking about the period from June 1 to June 28, which was the date before the lightning—in terms of interruptions, I think here, from the data I have, there was something like approximately 55 automatic interruptions, approximately 65 manual interruptions, and approximately 14 outages.

Now, what I am trying to get at here, is that representative nationwide in air traffic control centers?

Mr. SHARP. Would you care to answer that, Mr. Thompson?

Mr. THOMPSON. I am not sure that the statistics——

Mr. EVANS. I think the report I have here is Mr. Acri's report on computer operations, dated 1976, from June 1 through June 30. So I just knocked off——

Mr. RANDALL. If the gentleman would yield, it might be a worthwhile question to ask Mr. Acri, why he has three separate columns in reporting here.

Mr. EVANS. Mr. Acri, would you care to answer the Chairman's question, and then we will come back to this.

Mr. ACRI. Yes, sir. After the outage of June 29, at that time——

Mr. EVANS. Would you speak up, please.

Mr. ACRI. Yes. After the outage of June 29, we did begin to get quite a bit of attention from the local press, almost daily calls from the local press. So I asked the data systems officer to make sure that I got daily reports on any outages from the previous days, so I could speak to those with some knowledge. They were very informal, not an official report, information for myself only. And they have become known as the "Acri reports."

Mr. EVANS. As I understand, for the future here we are going to be requiring all the reporting of all interruptions and all outages, so that your more complete reporting here will be more the standard in the future.

Mr. ACRI. Yes. But those kinds of reports that you have there were informal reports to me with short explanations, and then the report that goes into the regional office and Washington—they are the same now as they were. So those reports are available. I think what you have there is a synopsis of the reporting that I got internally, informally, and it was not official.

Mr. EVANS. Can we rely on this information then or not?

Mr. ACRI. Not for the purposes you want. That is for my own purposes. And there were small explanations to go with that for my purposes only.

Mr. EVANS. As I understand, we are talking about now all and the same here, because I understand Mr. Sharp to say that all interruptions will be reported, all outages will be reported.

Now, my question is, in these outages and interruptions, did they occur between June 1 and June 28—is this a document that we should not be examining because it is fictitious?

Mr. ACRI. Those outages did occur. There was a difference of what we call an outage and an interrupt at that time, and there were some differences between AF and AT internally.

Mr. EVANS. I don't understand that.

Mr. RANDALL. You are going to have to help us on these acronyms.

Mr. EVANS. Can you help me?

Mr. ACRI. Yes, sir. Airway Facilities, which is the maintenance section of the center, and Air Traffic, which is my section of the center. And, of course, not being an automation man myself, I tend to call an interrupt an outage, and there is a difference in AF. Therefore, when we talk interrupts and outages, it is like me talking AT and AF to you, I guess—not being deeply involved in that aspect.

Mr. EVANS. Mr. Sharp, is everyone going to be operating under the same definitions and criteria, whether you are in the facilities section, or whether you are in the air traffic controller section, in the future, or are they now, or what?

Mr. SHARP. Yes, sir; they now are and will be operating under the same definitions. And those will be the bases for the determination of the extent and scope of interruptions or outages.

Mr. EVANS. OK. I hope our meeting doesn't take an overabundance of time here today. But to still get back to my original question, again, are these interruptions and outages which I presume did occur on dates June 1 through June 28, are they representative of normal numbers of outages and interruptions at air traffic control centers throughout the United States or were there abnormal problems in that period of time before the lightning strike on June 29 here at the Indianapolis facility? That is the only question I am really trying to get at here.

Mr. THOMPSON. Outside of the week of June 27, which includes the 29th, through approximately July 18, when we did have an unusually high number of instances in Indianapolis, the number of outages that have occurred in Indianapolis——

Mr. EVANS. Other than during that time period.

Mr. THOMPSON. Right—is typical of any other center or approximately equal to the mean of the other centers.

Mr. EVANS. Including the period June 1 to June 26, 27, that is typical, to quote you.

Mr. THOMPSON. As a matter of fact, it is true in the data through the September 30 data that we presented to you.

Mr. EVANS. OK. That is what I am trying to find out.

What percentage of the outages during normal operations would you say, Mr. Sharp, are caused by negligence of air traffic controllers?

Mr. SHARP. I am not aware, Mr. Evans, of any of the outages that are caused by negligence of air traffic controllers.

Mr. EVANS. That is not a part of the reporting system now nor will it be in the future?

Mr. SHARP. No. And I am not aware, as I say, of any case of negligence. Obviously errors can be made in entering data or pushing an incorrect button. But I am aware of no instance where negligence was involved.

Mr. EVANS. So these normal computer operations are problems within the computer system itself.

Mr. SHARP. Yes, sir.

Mr. EVANS. OK.

Can I ask, then, what guidance or supervision is given to the air traffic controllers with respect to these interruptions and outages. Could you just briefly explain to me what happens when there is an outage, in terms of what the supervisors or the management of the facility do?

Mr. SHARP. I would like to defer to Mr. Acri to discuss this, since he is more closely associated with it.

Mr. ACRI. If I understand the question, what does a controller do when he has an interruption?

Mr. EVANS. No. What I am trying to get at here is what do the supervisors do, what are the guidelines, if any, that management follows whenever an interruption or an outage occurs? Let's talk about outages.

Mr. ACRI. OK. If an outage were to occur, of course the assistant chief in charge would be notified. He would immediately——

Mr. EVANS. I'm sorry—just to get it clear in my own mind, is he located there on the floor?

Mr. ACRI. He is on the operational floor, and he is in charge of the air traffic people operationally during that particular shift that he is on duty for. He would immediately consult with the systems engineer, who is his counterpart on duty on the floor and responsible for the maintenance area. They would then determine the nature of the outage, whether or not it would be lengthy, and make a determination as to whether or not to go broadband, radar, as a facility.

Mr. Evans. So they normally can tell, then, what the duration of the outage would be?

Mr. Acri. If we are talking about an outage. Now, remembering that we say an outage is a minute or more.

Mr. Evans. Right. So after, let's say, 1½ minutes or so, they can pretty well determine how much longer that outage will last?

Mr. Acri. Yes. But it wouldn't be fair to say they would wait 1 or 1½ minutes. There are other things being done, and there are other decisions being made within the areas of specialization or at the particular operating positions, depending upon the traffic and how busy the controller is at an individual position.

Mr. Evans. OK.

Let me ask you, Mr. Sharp, again, a question. I don't remember—it could be my own error here—I don't remember from our investigation hearings that we held down in Oklahoma City exactly what amount of briefing or instructions are given to the controllers at that point during their training, as to how to deal with interruptions and outages. Perhaps you could explain what type of training goes into that development of knowledge on their part.

Mr. Sharp. Again, Mr. Evans, I would like to defer to Mr. Patterson for that discussion, since he works in that particular activity.

Mr. Evans. OK. Mr. Patterson.

Mr. Patterson. Except for briefly, and I am sure academically if at all at Oklahoma City in the academy, there is no training given for transition period between narrowband and broadband.

Mr. Evans. Would that not make sense, to establish that as a part of the curriculum or training?

Mr. Patterson. I am not sure at that point it would. The training for air traffic controllers at the academy is a very basic developmental course, and they are not to the point where they would be working radar for another 1½ to 2 years.

Mr. Evans. OK. So I guess what I am saying, other than just continuing their training, learning in a facility itself, a control center, they are not given any formal training or instructions what to do in an outage or an interruption. I am just trying to find out at what point during the time, if at any point during the time, are they given instructions as to how to proceed, given that type of a situation which does frequently occur.

Mr. Patterson. I would rather not speak to whether or not it would be appropriate to develop a course which we do not have right now for a transition period. The only training they get right now for transitioning, what you do mechanically and physically to transition from a narrowband to a broadband configuration, is in an on-the-job training type of operation. The separation standards, the methods of separation, are the same between the two. The thing that they would have to learn is how to push the button, how to pull the scope down, how to make up a shrimp boat, and who they should coordinate with that they don't have to do with narrowband.

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Mr. RANDALL. Would the gentleman yield?

Mr. EVANS. Yes.

Mr. RANDALL. The gentleman from Indiana has made a very excellent point here, it seems to the Chair. You say they do not do much down at Oklahoma City. We have been down there a few times. If the time permitted before the end of the year, we would get back again. But surely you use a journeyman's system—all of this business about on-the-job training and all of that.

Whether you do it at Oklahoma City or at the centers, doesn't it make sense to you, just plain old ordinary commonsense, to train these people a little bit on how to handle an interruption—give them a little seminar someplace?

Let me read into the record right here a report that this subcommittee issued sometime earlier this year. We are talking about "Human Errors and Related Deficiencies in FAA Air Traffic Control Systems." On page 31, I want to read this into the record. This is the National Transportation Safety report on the Carleton near-collision. I am going to quote it.

> Based on the high percentage of human failure in the ATC system, the Safety Board believes that as long as the human element is part of the total system, an individual's level of competence, the quality of his performance and his understanding of his primary responsibilities must be given as much——

And now we get down to the key word—

> managerial attention as the equipment that he operates.

That is what we are talking about here. If you don't do it at Oklahoma City, you ought to be doing it someplace.

Mr. PATTERSON. Mr. Evans, I would like to see if I could distinguish between what I was talking about as transition and broadband training. We in fact do give training on the broadband system. We do rotate all controllers through once a week, through the shift where our narrowband system is shut down by design, and they do get hands-on usage, using broadband. I was referring to that period when you might have an interruption, and the formalized training that we do not have at this time for the transition.

Mr. EVANS. From the narrowband to the broadband you mean or during the transition in training?

Mr. PATTERSON. Yes, sir.

Mr. EVANS. Narrowband to broadband, you are saying.

Mr. PATTERSON. Yes, sir.

Mr. EVANS. Talking about management here for a moment, as I understand it, not all controllers, Mr. Sharp, check their broadband radar when they come on duty. Do you think that there should be some type of a checklist that should be met, as shifts change at these centers? Since we are talking about often having to go to the broadband usage, or perhaps Mr. Acri, if it is more properly a question directed to you—if we are talking about having to make these switches, what I would determine to be fairly often, doesn't it make sense to insure some way, whether it is through a checklist procedure or some other method, that if they do have to move from reliance on the narrowband system to the broadband, that there be some type of insurance here that the broadband is properly adjusted, working, and whatever?

Mr. RANDALL. Before the witness answers that question, I want to compliment the gentleman again for asking a very penetrating question here. What he is talking about is just the simple old thing the pilot has to do before he starts that plane, that checklist. What is wrong with the controller going through a checklist? You are supervisors. We are going to ask you a lot of questions in a minute about what the supervisors have been doing and have not been doing. But isn't that what you are talking about?

Mr. SHARP. Mr. Evans, may I comment on one point of the question and I will ask Mr. Acri to comment on another.

One—from the technical standpoint, each radar system that provides data to the Indianapolis center is in fact checked at least once each 8-hour period. We have a maintenance program that requires the certification of the technical performance of all of the radar data feeding the controller positions, at least once each watch. And with respect to the controller verifying the data, I will defer to Mr. Acri for a comment.

Mr. ACRI. We do have a requirement at the beginning of each shift that the controller should check his broadband against narrowband to see that the targets are lined up. I have no information that it is not being done. I do not have a checklist. However, if you have any information that it is not being done——

Mr. RANDALL. Would the gentleman yield.

Mr. EVANS. Yes.

Mr. RANDALL. The staff has been up here for a while. We have been into this thing lots of times. That is the key to what we are talking about. They don't always do it. They should do it, but they don't do it. We may have to put one of the staff on the stand after a while to make the record complete. They don't do it.

Mr. EVANS. Well, again, continuing to talk about some of these potential problems with the narrowband system—would you say, Mr. Sharp, that during periods of the year when new computer programs are being introduced into the system—and I understand that occurs perhaps beginning in the midpart of many years—is there any type of prior notice given to the controllers that "We are going to be introducing some new programs today and you should expect a number of unusual problems with the system." Or is that just kind of left to act as a surprise element?

Mr. SHARP. I am sure it is not left as a surprise. Again I would defer to my colleague, Mr. Acri, to speak to this point.

Mr. ACRI. If the system is in a condition which we would consider unstable, and we were in a condition after the lightning strike of June 29, we do caution our people. If we are making a program change that should not affect the system, but there is a possibility that it might affect the system, we do warn those people that we are going to make some kind of a change and that they may get a momentary interruption so that they are aware of it.

During that period of time when we did not have our power constant source, and we were bypassing it, it was during the thunderstorm season, and we did have to make some decisions then to change over to broadband rather than take a lightning strike and have a changeover. So we did do some of that. And we do try to keep the people informed of anything out of the ordinary in that area.

Mr. EVANS. Are there any nationwide guidelines for this type of information flow to the controllers?

Mr. THOMPSON. Yes. Computer programs are released typically every 6 months. There are a series of events that are part of delivery of the computer program. The first one is notification of all regions of what changes are expected to be made in that computer program.

Mr. EVANS. Would you speak up, please.

Mr. THOMPSON. The second one is the identification of the specification changes. And finally we deliver the computer program and other documentation to the facility. But the first notification is some several months in advance and identifies what changes are going to be in the program. So the facilities then may begin whatever training or notification of the control personnel that is necessary to adapt to the new computer program changes.

Mr. EVANS. All right. So at other times during the year, if there are program changes, the centers are notified, they in turn, if necessary, conduct training seminars to instruct the controllers in potential problems that they may come up against, given whatever the changes might be.

Mr. THOMPSON. Or whatever change in procedures would be necessary.

Mr. EVANS. All right. For what length of time has this been the policy?

Mr. THOMPSON. This has been the policy for several years, anyway. I am not sure exactly of the time.

Mr. EVANS. Ever since we have had the narrowband system this type of notification has been carried out.

Mr. THOMPSON. At least, yes.

Mr. RANDALL. Will the gentleman yield?

We are talking about maybe two or three different things here. You say this has been going on for years. Actually you have not had this system for years. This has only come in in 1974. We are talking about one of two things. You can notify people what is going to happen. We are talking about an alert over here, when you are going to start changing, modifying the program, the software, in other words. How long has that alert been in effect? It can't have been in effect over 2 years, because you have not had the system over 2 years.

Mr. THOMPSON. We have had the machinery in the field with programs for other purposes for longer than 2 years.

Mr. RANDALL. I see. You are saying to this subcommittee you have had this alert Mr. Acri is talking about for a long while.

Mr. THOMPSON. I am not sure but what we are confusing two points.

Mr. RANDALL. I think we are. We started out talking about an alert, that you are going to alert the controllers that there are going to be some changes coming down the road, and to look out for them. You say you have had that for several years.

Mr. THOMPSON. That alert has been given to the facilities for several years, that is true, sir.

Mr. RANDALL. We are getting the old divided line between facilities and people. We are talking about people here, alert to the people, the controllers. How long has that been going on, and where? Is it nationwide, or just here in Indianapolis?

Mr. THOMPSON. The intent is to do it nationwide. Now, I should let Mr. Acri speak for this facility.

Mr. RANDALL. Mr. Sharp, you are the facilities man nationwide.

Mr. SHARP. Yes.

Mr. RANDALL. Where is the personnel man nationwide?

Mr. SHARP. He is not with us today. There are two basic elements of the organization involved here today, air traffic and airway facilities. I represent the airway facilities organization. Air traffic has no national representative here today.

Mr. RANDALL. Then we cannot ask the question, except in terms of what the facility does. And so we are back to how long has this alert been going on, is it done nationwide as to facilities? That is the question. Is it done nationwide or just done here at Indianapolis, where you have had the outages?

Mr. ACRI. Mr. Chairman, I have worked in the Chicago center, and I have been associated with the Cleveland center as a specialist from the regional office, and here. And I would say that is generally true in all facilities. But I think we may be talking about two things.

Mr. RANDALL. I had a suspicion we were.

Mr. ACRI. Yes. I think Congressman Evans was talking about problems day-to-day that might occur. I was answering that question in that if we have an idea that we are going to have a problem today, 10 minutes from now, an hour from now, or something locally, internally, we have an alert for that. Now, if we are talking about program changes that would affect software and would affect the work force, and how they would do their job, they would get those informal briefings, locally, and every facility would get briefings to bring them up-to-date on that particular change.

Mr. RANDALL. All right. I think we are pretty much talking about the same thing. It is not going to do much good if you tell somebody who is handling some equipment that you are going to change the equipment, because they are going to know that sooner or later, anyway. In other words, they are going to have to adjust the equipment, reprogram it, or whatever you call it. But the point is—staff has just handed me this memorandum—that at least as the staff understands it the controllers do not get the word. That's the point.

The controllers do not get the word. Do you have any evidence that they do? You are talking about facilities. What we are trying to find out is what does facilities tell the controllers, and when, and how far in advance is the alert? Is it done nationwide or only in Indianapolis?

Mr. ACRI. No. I can go back with an example—when the conflict alert feature became available for the controllers. They were briefed on the conflict alert, how to handle it, how to use it, and what it would give them. And that is done formally through briefings.

Mr. RANDALL. Regularly and how often?

Mr. ACRI. We have a briefing session set up daily for 1 hour, 2 to 3, and as they rotate through the shifts, every man is briefed once a week on any given subject. It could be conflict alert, a new program change, it could be on deficiencies noted.

Mr. RANDALL. We will get around to this relationship between the supervisor and the controllers after a while.

Mr. Evans, I am sorry I interrupted you.

Mr. EVANS. No problem, Mr. Chairman.

I have a question going back to what we have discussed a little earlier this morning.

Mr. Acri, if you could describe for me what it is like or what the atmosphere is on the floor when an outage occurs.

Are there questions that arise like—do we wait out this momentary interruption, do we wait out this interruption to see if it becomes an outage, or is there any way to know that an outage is an outage when it begins? What happens in terms of the supervision there on the floor when an interruption occurs?

Mr. ACRI. Well, first of all, I think I ought to point out that our people are well trained, and to get to a position of a radar journeyman controller, we are talking about 3½ to 4 years. So they have a very good background, experience and training on how to handle all types of situations.

Mr. EVANS. Now, that is the controller himself.

Mr. ACRI. Yes, sir.

Mr. EVANS. What about the supervisors there on the floor? What type of training are they required to have?

Mr. ACRI. The supervisor has come up through the ranks and has all of that training plus supervisory training. So he has what the controller has, plus.

Mr. EVANS. OK. If that is the case, then, we are talking about supervisors with only a very short-time amount of knowledge in working with the narrowband system, is that correct, since we have only had the narrowband system for 2 years. Are all our supervisors just recently designated supervisors, or have they been supervisors for longer periods of time, and thus am I correct in presuming they have very little experience with the narrowband system?

Mr. ACRI. We have supervisors that fit into both categories. Some have been quite a while, and some very recently.

Mr. EVANS. Mr. Sharp, aren't there certain types of guidelines, experience, criteria, that supervisors are required to meet nationwide in terms of knowledge of the equipment that they are supposedly supervising controllers on the use of?

Mr. SHARP. Yes, sir, there are. I would like for Mr. Patterson to respond to that.

Mr. PATTERSON. Mr. Evans, our supervisors are required to remain current and check out in whatever operational system is being used. The supervisors who were controllers under the old broadband system, or even before, are today required to remain current in the narrowband system.

Mr. EVANS. Do they undergo training then in the narrowband system? I don't understand how they are versed in the narrowband system if they have been supervisors under the broadband.

Mr. PATTERSON. They still remain current and work air traffic as controllers. Not as much, but they have to maintain so many hours a week as a controller, as well as being supervisors. They are still able to control aircraft.

Mr. EVANS. So they can take over any system or any position on the floor, whether it is controller or whatever, if the need arises, and work that system, work that computer, with the same or at least close to the same degree of efficiency as a person that has received all of their training under the narrowband, is that correct?

Mr. PATTERSON. They are required to be able to take over that system and work aircraft. We do not require them to be current in each sector within their area of responsibility. But they have to be current at least in one sector of operation within their area and they are required to be able to take over that position.

Mr. EVANS. How do they go about achieving their status of being current, as you say?

Mr. PATTERSON. They are required to get—I am not positive of the hours, I think it is 4 hours——

Mr. EVANS. I think it would be interesting for the subcommittee record if you would submit that.

Mr. PATTERSON. I have just been told it is 4 hours per week, they are required to be on an operational sector, working.

[Subsequently, FAA advised that this time period and frequency should be stated as 8 hours during the preceding 30 days. See p. 37.]

Mr. RANDALL. You mean a supervisor is?

Mr. PATTERSON. As a controller, yes, sir.

Mr. RANDALL. That is very refreshing, the first time we have heard that. We would like to know honestly and straightforwardly whether that is done nationwide or not.

Mr. PATTERSON. Yes, sir, it is a nationwide program.

Mr. RANDALL. I know it is a nationwide program. But we are going to try to interrogate some of the folks out there tomorrow, and find out whether that is really done or not.

Mr. EVANS. How long has that been the program that the FAA has followed?

Mr. PATTERSON. Mr. Evans, in numbers of hours it fluctuated. But the basic requirement for a supervisor to remain current has been in effect—it has been a number of years.

Mr. EVANS. All right. Going back there to where we were, Mr. Acri, before the interruption—would you go ahead and describe to me what the situation is like there on the floor when an unscheduled interruption occurs; whether it continues as just an interruption or it goes beyond a minute and becomes an outage, in terms of the supervisor.

Mr. ACRI. The outrage, of course, is officially described. But what we must remember is each controller, with all his experience and training that he has, has to make a determination depending upon the amount of aircraft he is working at that particular moment. If I were sitting at the radarscope and had two aircraft, and I had an interrupt, I would not be too concerned, and I might flip the button to look at the broadband and flip back to narrowband. If I were working 10 aircraft, I would probably go to broadband, and put the scope in a horizontal position and notify the supervisor, "I have too many aircraft to wait to determine whether or not it is an interrupt or a long outage." And it would depend upon the traffic situation at that particular time. And we also have to consider if a fellow has 10 aircraft, how many of those aircraft are actually at a point in flight relative to another aircraft that we would have to take some immediate action.

Mr. EVANS. You say you would flip back and forth between your narrowband display and the broadband. But as I understand, that is a complete operation of pulling down——

Mr. ACRI. That can involve a complete operation. But I can go back and forth by just hitting the button. I can have broadband and hit the button again and have narrowband, if narrowband is up. We are talking of doing this during an interrupt. So there is no—I can't give you an exact time or an exact situation that I would say I am going to broadband or I am not, or I will stay in narrowband or not, because those are unique situations, and they are never repeated. It depends upon the traffic situation at that particular moment and all the other coordination that may be going on.

Mr. EVANS. So the number of planes, their positions——

Mr. ACRI. Relative to each other.

Mr. EVANS. Positions relative to each other.

Mr. ACRI. And that would probably be the biggest determination, whether or not the fellow is going to put the scope in horizontal or not. He would probably go back and forth from broadband to check his targets.

Mr. EVANS. Now, this is a decision that the controller himself is making, is that correct? Is the supervisor immediately made aware, any time the screen goes blank or the positions are frozen?

Mr. ACRI. Again, I have to point back to the training. These fellows don't just start working radar after they walk in the door. It takes 4 years of training. We don't have one supervisor for each controller. So we expect these controllers to make some independent decisions relative to their situation in those kinds of cases. And they are well-trained to do it. That does not mean to say if there is a difference of opinion the supervisor may at that time make a determination and of course his word would be final. He is responsible for his actions. What normally happens is what I told you—would depend very much upon what was happening and how many aircraft there were in the sector and how they related to other aircraft in the sector at that particular time.

Mr. EVANS. OK. Then could you explain to me what is the purpose, what is the role of the supervisor on the floor?

Mr. ACRI. Well, the supervisor has many, many roles.

Mr. EVANS. If you could explain a few of them, I would appreciate it.

Mr. ACRI. The supervisor is there to supervise the work force in that particular area. If everything were going smoothly, he would supervise coffee breaks, lunch breaks, training, supervise those people that had some local test they might have to take, those kinds of things.

Mr. EVANS. He is sort of a personnel director there on the floor.

Mr. ACRI. That would be a simplistic form of what a supervisor actually does. He has to know his people. He is involved in the performance of improvement programs, counseling sessions, individual discussions, numerous things. He also has some reporting and some administrative duties that he has to take care of. And he does some of that on the platform.

Mr. EVANS. Mr. Chairman, I will turn the questioning back over to you.

Mr. RANDALL. All right.

To go back to this very helpful and reassuring comment that was made a moment ago, every supervisor takes 4 hours a week at a controller position. The key question is—I don't know whether you can respond to this or not—it is going to take a lot of oversight and investigation to find out if you are doing it. It is not going to do that supervisor any good to sit around 4 hours if he puts in a half-hour or an hour sometime Sunday noon or Sunday morning, or sometime in the middle of the day. Does that supervisor actually go on and do this job, a controller's job, on a Sunday night, when the pressure is on? That is the important thing. And is that done or not? And if you don't know, we are going to have to find out whether it is done or not. This is the key to the situation. Is this fellow going to do it when the pressure is on or is he going to be looking out the window when there is nothing going on on a Sunday morning?

Mr. PATTERSON. The supervisors are required to take over-the-shoulder evaluations on their abilities.

Mr. RANDALL. We are not talking about that, Mr. Patterson, if I may say so. You know what we are talking about.

Mr. PATTERSON. Yes, sir.

Mr. RANDALL. We are talking about getting in there and doing the job when the heat is on. Does he do that?

Mr. PATTERSON. Yes, sir. What I was trying to say is he is required to take the same over-the-shoulder evaluations that a controller does, and his job is dependent upon him being able to handle situations under that kind of situation. My answer—if he always gets in or is able to get in when the heat is the heaviest, I could not answer that. But he has——

Mr. RANDALL. That is what we are trying to find out. That is when he ought to be there, if he is going to be as good as the controllers are.

Mr. PATTERSON. I hope I didn't intimate that he is as good a controller as the controllers, because that is not correct.

Mr. RANDALL. Don't you think maybe he should be?

Mr. PATTERSON. No, sir, I do not.

Mr. RANDALL. He is just going to be kind of a watchdog. What if he is called upon to take over sometime? You said personnel director, or something—he is going to watch coffee breaks, lunch breaks, he is going to counsel. He shouldn't ask his men to do anything he does not do, whether it is in a war or wherever. Isn't that what a supervisor should do?

Mr. PATTERSON. Mr. Chairman——

Mr. RANDALL. Back to the original question—does he get in when the heat is on, when the going is rough?

Mr. PATTERSON. He is required to meet proficiency requirements as is a controller, sir.

Mr. RANDALL. Well, somebody somewhere along the line will or should be able to answer the question whether he gets in at a high traffic peak or whether he just sits around on Sunday morning sometime.

Mr. SHARP. Mr. Chairman, we will try to provide you some information on that subject.

[The information follows:]

To be currently qualified on a radar sector, first-line supervisors must satisfactorily perform the duties of the sector for a period of 8 hours or more during the preceding 30 days. Although FAA's national order on air traffic does not prescribe the volume of traffic that must be present when team supervisors perform these functions, supervisors would not be expected to perform these duties when traffic conditions are unusually heavy or unusually light but rather when traffic conditions are adequate to ensure proficiency on all relevant duties.

It is essential for a team supervisor to maintain proficiency since, under the Technical Appraisal Program (TAP), first-line supervisors receive quarterly "over-the-shoulder" training reviews identical to those given to controllers. During these quarterly reviews, supervisors must demonstrate technical proficiency to a second-line supervisor or to another individual designated to conduct the review. It follows, therefore, that supervisors must maintain technical proficiency on a continuing basis in order for them to satisfactorily demonstrate that proficiency during the quarterly "over-the-shoulder" review.

Mr. RANDALL. All right. The clock on the wall says quarter after twelve. There are some commitments that some of our colleagues have. We are going to go through and try to finish. But we are going to have to have a little break for the benefit of the reporter. As I see it, we have some more questions for you good gentlemen. We are going to have some controllers to listen to next. And so if the gentlemen of the FAA want to have a sandwich, we had better declare a recess of about 10 minutes here for the reporter to get up and stretch a little bit. We will resume at 12:30, and go ahead with the controllers. Then we will be back with you gentlemen about 1:30 or something like that.

[Whereupon, at 12:15 p.m., the subcommittee recessed, to reconvene at 12:30 p.m., the same day.]

## AFTERNOON SESSION

Mr. RANDALL. Mr. Logan, will you come up to the table with Mr. Foltz.

The subcommittee will resume its hearing.

At this time we are, in effect, hearing the other side of the aisle, if we can use that expression, as in Congress. We are listening to a different viewpoint of the problems of interruptions and outages. We are now going to hear from some air traffic controllers. We have heard from the FAA officials.

According to our agenda, the first witness will be Mr. James Logan, who is an air traffic controller for Indianapolis ARTCC.

Will you proceed, sir.

## STATEMENT OF JAMES LOGAN, AIR TRAFFIC CONTROLLER, INDIANAPOLIS ARTCC

Mr. LOGAN. I have a prepared statement I would like to read.

Mr. Chairman, I am testifying before this committee in the interest of safety and of the air traffic controllers. I am the chairman of the Facility Air Traffic Technical Advisory Committee.

Since the implementation of the RDP, we have been able to handle more aircraft with this highly sophisticated equipment. Though there are some unsolved problems with the system, I believe RDP is a step forward. One of the drawbacks to the RDP system is the occurrence of radar outages which not only create operational hazards, but more importantly sustains an environment that increases the chance for an aviation disaster.

With no warning at all, you are battling the element of surprise. Abrupt confusion takes hold of your mind as you immediately turn toward preventing the ultimate disaster—a midair collision.

There is approximately a 45-second to 5-minute time lapse while making the transition from narrowband to broadband. This can result in a situation out of control. This time lapse is directly proportionate to the traffic volume and degree of complexity when the failure occurs. This period of time may seem relatively small to the layman, but to the controller it seems like infinity. When only moments before all was running smoothly and well in control, utter chaos appears from nowhere. A situation such as this becomes more than a control problem; it becomes one of survival.

Up to the present, "Lady Luck" has been with the controllers and the flying public. But what happens some day when she's overlooking Los Angeles and doesn't have time for Indianapolis? I may be speaking in generalities, but I am also very much speaking of realities. This situation is very real and very present.

Since June 29, 1976, I personally have been involved in four RDP outages. Only one of these four outages was less than 20 minutes, while the other three exceeded 40 minutes. One of these even exceeded 1 hour. This is not to mention momentary blinks and outages of less than 1 minute.

As a result of these outages, my control techniques have been forced to change. I no longer "play them close" as we say. That is a minimum of 5 miles separation between all aircraft at the same altitude. I have increased my separation standards in order to give myself and those dependent on me a fighting chance for survival as well as trying to avoid the potential disaster.

The stress and mental strain involved in the transition from RDP to broadband is truly a psychological nightmare. There is the constant fear overhanging each controller, preying on his confidence in the equipment, wondering if this damn thing is going to go down, and if it does, is my best going to be good enough.

A controller can give 100 percent during the transition from RDP to broadband and still face the ultimate disaster. This unnecessary extra stress is not conducive to the controller's mental welfare or confidence and dulls his ability to do the job as he was trained to do. His ability to function for the welfare of his family is jeopardized and often creates havoc in his own private life. Although this does not happen to all controllers, it could potentially ruin any one—and one is too many; not to mention the innocent lives at stake in the skies.

We ask ourselves daily as we report to work, "What if", wondering. But if something positive is not done soon to correct this RDP outage problem, the uncertainty will most definitely become tragedy.

I would like to walk through what basically goes on from RDP to broadband in a radar outage transition.

This outage arrives without warning, totally unannounced. The first hint that something is wrong is when the clock stops at the top of the radar picture. You start to think about a possible outage and then the radar screen flashes "Not Updating Display." "Is this an outage or a momentary blink", you ask yourself. You then check the broadband radar to see if it is still OK and adjust it if needed. Quickly you check back to see if the radar is still not updating. If not, this is the time to act fast. The decision has been made to go to broadband radar.

First the scope must be pulled away from the console. This sounds very simple but at times can be a very difficult maneuver. The release button must be depressed from underneath the console near the floor and the scope pulled out. This task is a separate entity; you cannot control aircraft and lower the scope at the same time.

Chips—shrimp boats—must be made on all aircraft, giving radar handoffs manually, receiving radar handoffs manually, and changing aircraft from discrete to nondiscrete codes. As each aircraft changes to the nondiscrete code, that aircraft must be reidentified. This process is usually skipped because of the critical time problem involved. If you were working 10 aircraft, this would be an approximate time period of 3 minutes or more used solely for identification of aircraft. Keep in mind that separation is the No. 1 responsibility.

All of these necessary preliminaries have detracted from your total concentration. Regaining the overall traffic picture is going to be difficult, but you do not have the choice of coming back later and finishing the job.

Now you begin to check and doublecheck the separation and make sure that all aircraft are accounted for. Remember that there is no conflict alert to help if a separation situation has been overlooked. Plans for future aircraft can begin instead of "controlling them as you get them." Shrimp boats can be made and flight strips read for traffic that will be worked in a short time. But even while doing this, you are still separating aircraft.

I have just stated a significant number of functions that must be accomplished in the transition from RDP to broadband. The functions detract from the total concentration needed for separating aircraft. The above functions all sound very simple and very routine, but, when they are all pressed into a small time parameter and detract from the main objective of separating aircraft, the situation becomes totally unsafe. This does not bring to light other problems which occur, such as imminent separation problems, navigation aid outages, frequency outages, aircraft deviating for weather conditions, plus various pilot requests.

In conclusion, I wish to make it clear that my intention is that of concern for the undue stress placed on the air traffic controller and the inevitable air disaster facing the national aviation public during an uncontrollable situation caused by an RDP outage.

That concludes my statement, and I would be pleased to answer any questions.

Mr. RANDALL. Thank you, Mr. Logan.

How long have you been out there, Mr. Logan?

Mr. LOGAN. I have been there 7 years in November.

Mr. RANDALL. This morning, earlier, we were talking about training at Oklahoma City, and this need for a seminar or some type of training after that, on these switchovers, changeovers, backups, things of that kind.

Review for us, if you will—that is why we asked the people from FAA to return, because based on some of your answers we will have some more questions for them—after you come out of the Academy, you become an apprentice at first, and then you become a journeyman?

Mr. LOGAN. Well, I hired on in Indianapolis. They sent me to the Academy. I was there approximately 2 to 3 months. They sent me back to the Indianapolis center facility, and I went through a training course that was approximately 12 weeks. I was then qualified to work the A type position, or write strips—no control functions at all.

I went through this process for approximately 6 to 8 months, and then went through another instructional period of 4 weeks, which was called precontrol. I went back to the platform to do the A duties, still no control, and was returned in approximately 6 to 8 weeks for a 3- to 4-month control classroom type work.

Mr. RANDALL. Classroom type, did you say?

Mr. LOGAN. Well, there is classroom——

Mr. RANDALL. Four to eight months?

Mr. LOGAN. Three to four. After completion of that 3- to 4-month period, I was sent back to the platform, or the control platform, where I started my training as a controller on what we call the manual positions. After being qualified in all manual positions, I think it was about 4 or 5 months, I was sent to Atlantic City for a radar school. And upon completion of the radar school, which was about 2 weeks, I was returned to Indianapolis where I started radar training and eventually became radar qualified.

Mr. RANDALL. Now, that is about eight separate intervals of training, on-the-job training, classroom, and so forth, before you ultimately get on a scope. Is this pretty typical of all of them?

Mr. LOGAN. Yes.

Mr. RANDALL. You go out to the academy, and then you come back to a center for 12 weeks; then you get on the A spot, writing strips for 8 months. Then you have a course of 4 more weeks in precontrol. Then you are back to the A duties for 6 to 8 weeks.

The thing that confused me a little bit there, which I have noted here as the sixth stage of training, 3 to 4 months in the classroom?

Mr. LOGAN. This is in the facility. It is a manual environment, the lesser stage of control, where we are taught how to control off the strips. This is not using radar or anything else.

Mr. RANDALL. That is usually at the center?

Mr. LOGAN. Yes, it is. I might also add, Mr. Chairman, that during this time parameter air traffic was short of people, and that is somewhat—my version is somewhat condensed as to now what they are going through.

Mr. RANDALL. When you actually get on a control platform, your first work would be the manual position. And 4 months after that you go over to Atlantic City and stay for 3 weeks. Does everybody all over the country go to Atlantic City?

Mr. LOGAN. No, sir. This was a trial period. I think there were only two classes of us that went out there. We actually controlled on a radarscope run by a computer.

Mr. RANDALL. What do the others do?

Mr. LOGAN. Most of the training is done right here in the facility.

Mr. RANDALL. And you finally come back at the last, when you have had your radar training, and go on a scope. That is the last thing.

Mr. LOGAN. Yes, sir.

Mr. RANDALL. All right. You have given us some very hard-hitting statements here, of the mental anguish, the situation that you finally say is more than a control problem, it becomes one of survival—talking about the ultimate disaster of a midair collision.

I would have only one comment—talking about "Lady Luck." We like to believe that when you get up in that situation, that prayer might help you a little bit, too—we believe that is going to have something to do with your survival.

This stress, mental strain that you have suggested, of a psychological nature—is there any way, any suggestion, any step—we are trying to be helpful and productive. I guess there is not a hearing anywhere that is of any value unless it comes up with some kind of attempted solution to the problems. We thought it was worthwhile to come out here, after we read this story in Computerworld about this situation. And you have given us your testimony.

What is your best judgment and your best summary of what we might do about this problem? You have listened to the Federal Aviation Administration this morning. You have heard their remarks about the supervisors. We are going to ask them some questions after you have given your answers and see what they have to say about your answers.

Now, what do you recommend?

Mr. LOGAN. I have a couple of recommendations. One of them is I think personally there should be a backup system to match the system we have. In other words, we should have two separate systems. Then there would be as far as I'm concerned a safe transition.

Another one is——

Mr. RANDALL. On that point, before we go ahead—you say a backup system to match the one we have. You mean as good as the system, or comparable, or what do you mean?

Mr. LOGAN. As good as the system we have. In other words, if we had two systems—we have got one system out there now. If we had two, you could go from one to the other. The system we are using now is inadequate for the volume of traffic we are having.

Mr. RANDALL. You mean right now it is inadequate.

Mr. LOGAN. For the transition period, I am talking about—not for the overall. I think we are able to handle a greater volume of traffic now with the system we do have. But the transition period from that RDP to broadband is, in a complex situation, almost impossible.

Mr. RANDALL. Well, you made a point that it seems might have considerable potential value. Are you saying it is too difficult to pull this thing down? Very dramatically you explained to us a minute ago what goes on during this period of stress, all the things happening all at once. You have got all of these problems of transition, you are all pressed into a small time parameter. While this is all going on, you still have to separate your aircraft. Tell us specifically what you believe could be done—a simpler way to bring the scope down, a simpler procedure to get the transition mechanically, as well as timewise?

Mr. LOGAN. Simpler mechanical transition is what we need. If I might add, it is easy to flick that button, I will have to agree with that, and your broadband is right there. But I don't know if you are familiar with the codes as far as nondiscrete and discrete.

Mr. RANDALL. We are going to ask you about that. Tell us the difference between the two.

Mr. LOGAN. All right. When you are working RDP, you are using discrete codes, 4-digit numbers. That is directly related to the transponder that the aircraft is using. On the broadband system, you are able or capable to control airplanes normally and most of the time effectively, with a double slash, two slashes. Now, when you are working RDP, if you remember Mr. Patterson's drawing, it showed a single slash, one control slash. If that aircraft or the aircraft you are working is not on the nondiscrete codes selected at the radar site you are working, or the sector, you are not going to get the double slash when you immediately revert to broadband. So you have to go through—you can make a blind broadcast for all aircraft to squawk a certain code, which would put them all on the same code. In other words, you would have double slashes for all aircraft. But you have to go back and reidentify each one of those aircraft.

Mr. RANDALL. Well, you are obviously involved with a complex explanation here. And if we may simplify it, if it is possible, you have suggested that this business between a single slash and a double slash, there is a period of blindness there between the two—is that what you are saying in effect?

Mr. LOGAN. That is correct.

Mr. RANDALL. That is the best I can do.

Mr. LOGAN. Yes. There is a period in there where it is possible that you will not even see that aircraft.

Mr. RANDALL. Well, all right. Let me go around the track again. You have said that you recommend and believe it is possible to get a simpler mechanical transition. It sounded pretty good this morning. All you have to do is push a button. You say it is easy to push the button, but that doesn't get the job done.

Mr. LOGAN. I immediately see the broadband, but I am in no way set up for controlling aircraft.

Mr. RANDALL. How long does that take?

Mr. LOGAN. You are talking about the transition?

Mr. RANDALL. Yes.

Mr. LOGAN. Depending on the complexity of the situation and geographical size of the sector, and the volume of traffic, it can take you up to 5 minutes, and you may not effectively do it for an unknown amount of time, I would only be able to guess, maybe 10 to 15 minutes.

Mr. RANDALL. And a lot is happening in that time.

Mr. LOGAN. Yes, there is.

Mr. RANDALL. And we know you are not an electrical engineer, electronic engineer, anything else, and not holding yourself out to be. But you are saying to us there has just got to be some kind of quicker mechanical transition where everything is going on there and possible disaster could result; there has to be some quicker way for the transition.

Mr. LOGAN. Yes, sir. If I might also add, I think also if we were given more warning, or we were given some warning that there was something the matter with the system, I think it would help.

Mr. RANDALL. Do you have any idea, can you give us any estimate, your best judgment, as to how this could happen, this sort of RDP? Could they build in some kind of little flicker or something before it goes out? How would you accomplish that?

Mr. LOGAN. I am not sure how they monitor the system. This is done by the system engineer. I am not completely familiar with that. But I do know, I am sure they would know more about the situation if there was somebody there watching it all the time. There is somebody assigned there, but that doesn't mean there is somebody there.

Mr. RANDALL. That's interesting. You say there is somebody assigned but it doesn't mean somebody is there? Who would that be who is supposed to be there and was not there?

Mr. LOGAN. That is—that would be—I am only under the assumption that belongs to the system engineer, and that would be a problem that they have.

Mr. RANDALL. Well, we are striving to be objective and recognize that there are two sides to every issue. But you are dealing with a situation here that the thing can go out abruptly, I suppose, in the case of a power failure—but are you saying to us that there would be some benefit if this big computer which is sitting over here in the corner someplace, maybe even in some other building—is it usually on the same floor with you?

Mr. LOGAN. Yes, sir; it is right on the same floor.

Mr. RANDALL. All right. I think what you are saying to us, if I interpret it rightly, is that maybe you have to go back to the old-fashioned way, somebody yell over there and say: "This thing is about to go bust, get busy." Some immediate warning, is what you are saying, is that right?

Mr. LOGAN. Yes.

Mr. RANDALL. Mr. Evans.

Mr. EVANS. If I can interrupt for a second, Mr. Chairman. If I remember correctly, when I was at the facility, it is really a double door separating the computer room from the actual floor situation?

Mr. LOGAN. Yes. But they have the monitor device right there on the platform.

Mr. EVANS. There is one other question. You said that there is no warning given. I wonder exactly to what you are referring. Are we referring to time periods during which there may potentially be a problem period with the software?

Mr. LOGAN. If I might read this—this is a computer strip sent out by the AC. "To all controllers"—on October 2.

Mr. EVANS. What is AC?

Mr. LOGAN. Assistant Chief. This is the way it reads.

Alert. Computer air handling units out of service. If unable to get the units back in service, the computer will shut down. Caution advised on separation.

This is excellent, but this is the only one I have ever seen.

Mr. EVANS. I think that is an interesting point, Mr. Chairman. If these warnings supposedly have been given since the establishment of the RDP system, where have the warnings been going all the time?

Mr. RANDALL. That is exceedingly interesting. I would like you to read that again for the record. Where does this come from?

Mr. LOGAN. This is put out in our computer system by the AC, the Assistant Chief.

Mr. RANDALL. Please read it again—and the date.

Mr. LOGAN. October 2. The time was 2007 Zulu.

Alert. Computer air handling units out of service. If unable to get the units back in service, the computer will shut down. Caution advised on separation.

Mr. EVANS. Now, this would be a warning internal to this center, is that correct?

Mr. LOGAN. Yes, sir.

Mr. EVANS. OK. We still have not come up with any of those warnings, then, that have been issued by the national office of the FAA to be passed on. OK. That is the point I wanted to clarify.

Thank you, Mr. Chairman.

Mr. RANDALL. How many of these strips or the print-out of these computers have you had? Is this the only one you have had?

Mr. LOGAN. That is the only one I remember.

Mr. RANDALL. The only one you have had at all, on October 2, 2007 Zulu. That would be about 8 o'clock London time, or whatever it is.

Mr. LOGAN. That is London.

Mr. RANDALL. I don't know whether we want to give him a medal or call him in as a witness, to see why he didn't do it more often, or thank him for doing it at all. Who is the Assistant Chief? He didn't sign it?

Mr. LOGAN. No.

Mr. RANDALL. Just somebody was good enough to do it, in this one instance, and that is all.

Mr. LOGAN. Yes, sir—that I know of.

Mr. RANDALL. Whoever the AC was, he was saying that the computer may shut down.

Mr. LOGAN. Yes, sir.

Mr. RANDALL. Will shut down.

Mr. LOGAN. If that problem is not solved, yes, sir.

Mr. RANDALL. Didn't tell you when—just that it may happen.

Mr. LOGAN. Yes.

Mr. RANDALL. Well, it is good. I think we have to say whoever he is, he should be commended.

You have heard the testimony of the FAA this morning about the fact that there is no safety problem here at all, everything is all right, there is no derogation of safety, there has been up to now at least no admission that these outages result in the diminution of safety. What have you got to say about that?

Mr. LOGAN. I have said most of it in my statement. And I am a very firm believer that up until now the transition period has seen "Lady Luck" on our side.

Mr. RANDALL. Mr. Evans.

Mr. EVANS. I found your testimony to be very interesting here. It is certainly not the picture that I received earlier this morning in terms of the ease of transition, nor the time period of transition.

You say that you, as an individual, as an individual air traffic controller, have increased your separation standards in order to lessen the chances for some type of a mishap, given the number of problems that you have experienced at the control center. Would that be a good step for the FAA to take nationwide, to increase separation standards, given the number of interruptions and outages and the duration that we are talking about?

Mr. LOGAN. No, sir, I do not think so. I believe that the separation standards we have are sufficient, when it is operational. When it is not operational—in other words, we are using the same separation standards we used on broadband basically, except for within 40 miles of an antenna site, we use 3 miles instead of 5.

Mr. EVANS. Within 40 miles of a what?

Mr. LOGAN. Radar antenna site. I don't think that increasing separation would solve the transition problem. All I am saying is I am giving myself—I am trying to help myself and my concern for the flying public right there.

Mr. EVANS. Well, now, the transition time here—we are saying 45 seconds to perhaps 5 minutes lapse, while making the transition from narrowband to broadband. The mechanical process here of pulling the scope away from the console—this is a period of time during which I believe you say you cannot control aircraft and lower the scope at the same time. What kind of a time frame are we talking about there? I take it that is less than the 45 seconds to 5 minutes.

Mr. LOGAN. Yes. It would depend, I suppose, a lot on your dexterity. But personally, I could probably lower one in 15 to 20 seconds. I have never timed myself. And I hope—I don't make a practice of lowering the scope, anyway, except in those transitions.

Mr. EVANS. I think in the interests of safety it is interesting to note that there is a period of time here, according to your testimony, when aircraft cannot be controlled by the air traffic controller when switching from narrowband system to the broadband system.

Mr. LOGAN. That is correct. It is a separate job in itself, lowering that scope.

Mr. RANDALL. While the gentleman from Indiana is looking over his notes, if he would yield, I would like to ask a question.

Mr. EVANS. Yes.

Mr. RANDALL. I thought it was significant that in response to the question of Mr. Evans, as to whether more separation would contribute to greater safety, your answer was no. Then you proceeded on and said something about within 40 miles of a radar antenna site, and I thought I heard you say 3 miles separation instead of 5.

Mr. LOGAN. Three miles on broadband radar.

Mr. RANDALL. What has been used on RDP?

Mr. LOGAN. Five miles throughout.

Mr. RANDALL. Well, doesn't it add up to sort of old horsesense, that with something going on here, all this happening that you very eloquently, articulately described, this nightmare, wouldn't it be better to order a bigger separation all the way around while that is going on?

Mr. LOGAN. If we cannot fix the outages, maybe, yes.

Mr. RANDALL. Just get on the radio and go back to the old-fashioned, old-time horse-and-buggy days, and say "Let's separate a little bit." Wouldn't that contribute to greater safety?

Mr. LOGAN. During a transition period, it would, yes.

Mr. RANDALL. That's about all you have left to do, isn't it? That is the only safety valve you have, isn't it?

Mr. LOGAN. Yes, sir.

Mr. RANDALL. Thank you.

Mr. EVANS. So in your opinion, then, you are stating that these interruptions, outages, that we are talking about, do present a threat to air safety, is that correct?

Mr. LOGAN. Yes, sir.

Mr. EVANS. I don't believe I have any other questions at this time, Mr. Chairman.

Mr. RANDALL. Does the staff have any questions of Mr. Logan? Does the minority have any questions?

Mr. TEMPERO. Thank you, Mr. Chairman, I have no questions at this time. I would like to mention that Mr. Thone asked me to express his regrets for not being able to be here today, and further to express to you his appreciation for your continuing concern with air space safety and your willingness to continue to pursue the subcommittee's efforts in this area.

Mr. RANDALL. Thank you. And I want to say that Charlie Thone is about as near an apolitical type as I know of. He is on both sides of the aisle. But we have never had any problems of any kind with our ranking minority Member. And that is a great way to run a subcommittee.

Mr. Romney, do you have any questions of the witness?

Mr. ROMNEY. Thank you, Mr. Chairman. Mr. Logan, earlier you may have heard a reference made to a procedure whereby the controllers would check out the broadband radar and their frequencies early on in their watches, to make sure they were adjusted, a checklist, a procedure that Congressman Evans mentioned as a possibility. Would you care to comment on that?

Mr. LOGAN. I believe that a checklist can be very valuable. But immediately upon assuming a position, it is not always feasible to go through this checklist. Some of it would depend on the time period in which you are assuming a radar position. Say it could be early in the morning, say 7 o'clock, and you have just come to work. The people that are working are too busy. They have too many airplanes. There are not enough people at that time. He has not enough time to go through that checklist. His first priority is separating aircraft. Later on he may be able to go through that checklist, but at that time he does not have time.

Mr. ROMNEY. Are you saying it should be done relatively early, however, in the watch?

Mr. LOGAN. Yes, sir.

Mr. ROMNEY. Thank you.

Mr. RANDALL. Well, on that point—believing as some of us do in the value of this checklist—it is the same as the pilot does. The pilot has to show up before he starts the flight, or else the time is figured in there some way. I can understand that 7 o'clock in the morning would be an extreme example. But maybe then, if that is when the time starts, there should be 10 or 15 minutes, or 20 minutes, whatever it takes to make sure of the checklist. Not everybody comes to work at 7 o'clock. They come at different times. But if the checkoff has any value, it should be enforced at the unpleasant hour of 7 o'clock on Sunday morning, I suppose—if everybody is busy, the supervisor or somebody in charge has to time the thing so they will have 5 or 10 minutes to go through the checklist. Doesn't that make sense?

Mr. LOGAN. Yes, sir, it does.

Mr. ROMNEY. Mr. Logan, you mentioned that you felt that there should be a backup system as good as the main system. Could you clarify that? And let me elaborate on why I wanted you to clarify it, if you would. The RDP is an extraordinarily complicated system. It is a system of systems that involves a vast number of elements, and people and programs. And, of course, because of its size it is subject to errors. You are not suggesting that there be another RDP set up elsewhere at the center to take over when the first RDP should experience an outage, are you?

Mr. LOGAN. Yes, I am.

Mr. ROMNEY. That would entail, however, the same problems presumably as the other. They would be operating on the same programs, would they not?

Mr. LOGAN. Yes, they would. But if they were to operate separately, not contingent upon each other.

Mr. ROMNEY. The fault would be in the program, and the program operating both the main and backup RDP would bring the same result, would it not?

Mr. LOGAN. I would have to agree with that, yes.

Mr. Romney. There is a question of cost effectiveness, perhaps, in there. Are you familiar with the DARC proposal?

Mr. Logan. Only what they brought up this morning.

Mr. Romney. That is all I have, Mr. Chairman.

Mr. Randall. All right.

Now, Mr. Foltz, are you prepared to proceed?

## STATEMENT OF PETER J. FOLTZ, AIR TRAFFIC CONTROLLER, INDIANAPOLIS ARTCC

Mr. Foltz. Yes, sir, I have a prepared statement.

Mr. Randall. Go ahead.

Mr. Foltz. Mr. Chairman, it is not my intention to come before this committee and maliciously discredit the Federal Aviation Administration, nor do I come before you to sing the praises of the Professional Air Traffic Controllers Organization. I am here today, as chairman of the local PATCO safety committee, to point out what we find to be a clear and present danger in our air traffic system. This is not solely our opinion but the opinion of the overwhelming majority of Indianapolis center controllers. We are in the unique position to see this day in and day out.

Although there is some dissenting opinion among controllers in general, we feel that a functioning RDP system is a very valuable tool for air traffic control. It has its flaws, which must be remedied. Most of these flaws constitute an inconvenience which controllers have learned to work around. However, the important point we would like to make is that most of these problems have been in the system since it was conceived. This fact simply exemplifies the pace at which problems are corrected in this computer.

Controllers have no way to safely work around the transition period involved in RDP failures. These failures are not inconveniences; these failures are bona fide safety hazards. They must cease now.

Do not misinterpret me. We are not asking to have RDP removed. We are rather asking to have it repaired and repaired now. Someone must, without regard to necessary man-hours or cost, solve this problem.

Controllers are not technicians. We only see the effect of these deficiencies, and the effect is terrifying. We do not even pretend to know where to begin to solve this problem. However, we know we live in a country whose computers have sent men to the Moon and back and whose computers have sent probes to Mars and returned crystal-clear photos. Why can't the FAA's computers at least operate when they are supposed to?

FAA contends there is adequate backup equipment to preclude any major safety hazard. The people who make these determinations sit in Washington or regional offices and are so far removed from the actual separation of aircraft that they could hardly be considered experts on the matter. If you must have a management opinion, talk to all the firstline supervisors. I think in all candidness, the majority could not help but agree with us.

Let me address myself to what transpires in an RDP outage. In order to control a sector, the controller must have a mental three-dimensional picture of his sector and the aircraft therein. He builds this picture by the use of his tools, these being his radios, radar, and flight progress strips. Remove any of these and the controller cannot function to 100-percent effectiveness for ATC.

When RDP fails, the controller is presented with a complete blank. He must immediately begin to reconstruct his mental picture, utilizing his radios, strips, and broadband radar. Broadband only displays mapping and targets. These targets will only be properly displayed if the aircraft codes are changed. This requires an action by the controller. Then each target must be reidentified. Therefore, though broadband is in fact instantly available, it is not immediately usable for separation purposes.

While the controller is accomplishing the code changes and reidentification, he must also mechanically lower his scope to the horizontal position and make shrimp boats for each aircraft. As you can probably see, with very few airplanes and no imminent separation problems, this may not be a difficult task. However, give a controller a considerable number of airplanes and a couple of imminent separation problems and you have the seeds of disaster. The more airplanes, the longer the transition time.

To repeat, Mr. Chairman, we must do something now. Please, let us, for once, act on a problem while we have a choice and not react when we have no choice.

Thank you.

Mr. Randall. Thank you, Mr. Foltz. You, too, have served up to us a very hard-hitting statement.

At the bottom of page 1, you deplore the pace at which these problems are apparently being corrected. You say again that the failure is not just an inconvenience, but it is sort of a mental anguish, mental worry, anxiety—and they are bona fide safety hazards.

You used the word "repaired." Do you ever talk to any of the technical people out there, any of the mechanical wizards that come around, the electronic engineers, who say there is any hope for any improvement in these outages? We know that no machinery is ever going to be foolproof. Do you hear any scuttlebutt around or any rumors around that they are making any progress to reduce the number of these?

Mr. Foltz. No, I have not.

Mr. Randall. You have not heard anything.

Mr. Foltz. No, sir.

Mr. Randall. You said, if computers can send a man to the moon, and so forth, and send back probes from Mars, we can have computers that should operate as they are supposed to. The Chair happens also to be Chairman of the House Select Committee on Aging. There are computers that have paid out some $23 million in erroneous Supplemental Security Income benefits, that may be pretty welcome to the dear souls, but there is no way to get the $23 million back; it is gone. That is simply a computer error. I suspect it is closer to $100 million, if we get all the facts in. I might add for the record that we have a disbursing office over in the Cannon House Office Building that is going through the agony now of trying to give a small percentage raise to some of the staff. Figures must be in by the 15th of the month. They tell me, we don't know what our staff is going to get paid in the month of October, and maybe some time before Christmas, all because of computers.

So while computers are a boon and a great thing, they are also an awful lot of headaches.

Mr. FOLTZ. I agree.

Mr. RANDALL. Well, on this backup equipment—you heard Mr. Logan. Do you have any ideas? His main point that he made was it takes too long for this transition. What do you have to say about that?

Mr. FOLTZ. I agree with him 100 percent. Of course, if you sit there in the sector and you have nothing to do, the transition is nothing. However, if you are sitting there extremely busy—the FAA demonstrated what the transition entails on their little chart this morning. You saw four strips there and four targets. Double, triple, quadruple that number, go up to 25 or 30, each individual aircraft taking a function, requiring a function on the part of an air traffic controller. This is a considerable amount of time. While the controller's attention is being diverted to getting his situation back to normal, although it would be a normal broadband operation, say, the airplanes are still flying, they don't slow down. And it is very easy to concentrate on one part of a sector, or one situation, or maybe two, three situations, and have a situation just slip right by you that you would ordinarily catch.

Mr. RANDALL. I was impressed by a comment you made on page 3. You say it is true that broadband is instantly available but is not immediately usable. So really, if it is not usable, it is not available. Availability means nothing. Isn't that about right?

Mr. FOLTZ. Yes, sir.

Mr. RANDALL. So, to say it is available is of little consolation if it is not immediately usable. And by that you mean you have to go through all of this business of reconstructing, I think you called it, the mental picture, where everything was before the blank.

Mr. FOLTZ. Yes, sir.

Mr. RANDALL. That means your backup is not usable for precious few minutes. How long is that?

Mr. FOLTZ. As Jim Logan said, depending strictly on complexity and numbers. I would believe in this particular situation, the number of airplanes, the number of individual transmissions one would have to make, the number of individual functions that one would have to make, just in order to get his picture back to what it should be.

Mr. RANDALL. Thank you very much. Mr. Evans?

Mr. EVANS. Thank you, Mr. Chairman. I note in your testimony you said that most of the problems experienced with the radar system, narrowband system, have been in the system since it was conceived. Would it be your opinion, then, that not much progress has been made by the FAA toward solving the problems that you confront in the system?

Mr. FOLTZ. There has not been a total lack of progress. However, progress has been extremely slow. Corrections of particular problems, problems which were in the system when it was conceived, as I said—we still have these problems today.

Mr. EVANS. Could you give me an example of the type of problem you are talking about?

Mr. FOLTZ. May I refer to one of my notes here?

Mr. EVANS. Certainly.

Mr. FOLTZ. These are out of personnel memos on which I have been doing some research over the past couple of weeks. This is a personnel memo dated August 24, 1973, which in a sense states that these are the problems which we have in this system, which we have to work out. Among these problems are limited primary tracking, loss of display of primary targets.

Mr. Evans. Let me interrupt just a moment here. What was the date of the memo?

Mr. Foltz. August 24, 1973.

Mr. Evans. And was the narrowband system in use at that time?

Mr. Foltz. The particular memo deals with the delay in declaration of IOC, which stands for Initial Operating Capabilities, I believe. Anyway, this was a declaration where we say our computer is ready to go, let's start phasing it in.

Mr. Evans. OK. But is this in reference to the narrowband system or the broadband?

Mr. Foltz. Narrowband.

Mr. Evans. And the narrowband was in existence, in operation, at that date in August 1973?

Mr. Foltz. No, sir. This is where it was beginning to be phased in. We were still using broadband as our primary means of separation. I don't remember for sure exactly at this time what phase we were actually in, but we had not declared initial operating capability yet. Therefore, we were not actually using it, we were not shaking it down as of yet.

Mr. Evans. So these are potential problems that it was felt would probably be in existence when the narrowband system was fully operational, and now today that it is fully operational, we still have problems like that. Is that what in effect you are saying?

Mr. Foltz. I will read it to you. On July 30, 1973, an implementation working group was formed to identify problem areas. The group as of August 24 found 10 major problem areas. And among these problem areas, what I would like to give you, to show you we still have the problems—loss of display of primary targets. I believe everyone here will tell you—if not I can show you documentation on various instances of primary target loss, where we just are not pointing primary targets the way we should be. A prime example is a pilot asked about some traffic he saw. The controller said he didn't see any, and then switched over to his broadband. There was a primary target there at or about 10,000 feet—I don't remember the exact altitude. These are targets which should be displayed on our radar-scope, if we are going to effectively do our jobs.

Mr. Evans. All right. Let me ask you to again speak louder if you can, and go ahead.

Mr. Foltz. Reliability of the system. That is what we are here talking about today. Beacon splits and false targets. We have this every day. This is where a target will pop up out of nowhere. I don't know the exact technicalities behind it. But you have a target right there, with your actual target that you are tracking.

Mr. Evans. This target that appears out of nowhere, is that an imaginary target or is that an actual plane?

Mr. Foltz. It is not a real target. It is a reflection. This is a technical problem, and I don't understand it all. I just look and see a target there that after close scrutiny I can detect is a false target, it is not a real target.

Mr. Evans. Continue, Mr. Foltz.

Mr. Foltz. OK. Display of weather. We don't really have much documentation on this. However, it is a pretty well-known fact among controllers that the weather display we get on our PVD doesn't have near the impact of the weather display we get off the broadband.

And those are just some of the problems that we have had at this time, and that we still have today.

Mr. Evans. All right.

Mr. Randall. While the gentleman from Indiana is preparing his question, if he would yield—the Chair has just stumbled upon a chart here that is going to be most important when we interrogate the FAA people, after they come back to join us. Here we have had a chart that has been prepared apparently by Mr. Thompson—who I want to say for the record we regard as one of the good guys, he has done a good job, a conscientious fellow. But he has given us a chart here, and he has told it like it is. But I want to see what you think about this. He has given us a chart here—we have planes all over this big area that we never did have a map on—all of this big area, that goes clear over to Ohio, down to Kentucky, around almost to Atlanta, comes back around the zigzag map. And there is a chart here that shows that we are handling anywhere from 200 to 1,000 planes over this vast area. And when you get up between the 600 and 800 mark, when you get up to the peak of the 800 mark, in the day shift, it is astonishing, it is disturbing and worrisome, that when you get to handling the peak number of planes is when our outages occur.

Do you know anything about that? Has it been your experience here as a fellow standing around and watching the outages—you go up between 600 and 800, and there is almost nothing happening down here where you are only handling from 200 to 400 planes. Is there anything to that?

Mr. Foltz. It has been my observation that the majority of the outages seem to occur during critical periods. However, you tend to notice them more at that time.

Mr. Randall. Here is a chart, and this chart tells it the way it is. Is it because the machine is getting tired or is wearing out, can't handle it, or what is the story? Can you help us with that?

Mr. Foltz. I don't believe I am qualified to answer that.

Mr. Randall. We are sure going to ask the FAA about that.

All right—I'm sorry.

Mr. Evans. That's all right. I appreciate your pointing that out, Mr. Chairman.

From your testimony, you said that the FAA contends that there is adequate backup equipment to preclude any major safety hazard. "The people who make these determinations sit in Washington or regional offices and are so far removed from the actual separation of aircraft that they could hardly be considered experts on the matter."

My question is, What type of input does the FAA request from persons such as yourself, air traffic controllers, that supposedly have the best knowledge of handling this narrowband system, at least that was the testimony, I believe, this morning from the FAA—what type of input do they receive from you or do they request from you or other air traffic controllers?

Mr. Foltz. Just off the top of my head I can say we have a form for controllers to fill out to solve problems, or turn them in to get an answer to a problem. It is an individual form—NAS—FDP or RDP NAS Operational Problems/Malfunctions. It is a very simple little form, where you have a problem, you just—I won't say "simple"—that was a mistake on my part. It is not a real simple form. You just have to check off what status your PVD is in at the time, and then outline the problem briefly. And supposedly they will come back and answer you. This is through data systems.

If I can go on a little further, there is a UCR form. Unsatisfactory Condition Report, which goes on to Washington; a USR form, Unsatisfactory Status Report, I believe that stands for, which stays in facilities. Supposedly all of these will get answers to correct a particular problem a controller turns in. And Jim Logan may be able to add some more to that. I don't know.

Mr. EVANS. So the normal process then would be as an air traffic controller, you would see a problem, come up with a problem of some type, you would fill out a report on it, send it in, and would you normally then receive some type of a report back on what type of correction can be taken, if any type of correction is possible, to solve the problem, or the report goes in and you do not hear anything further on it?

Mr. FOLTZ. This is the theory behind the system.

Mr. EVANS. What is the actual case? Do you hear back?

Mr. FOLTZ. In many cases, yes, you do hear back. I have found cases where people do not receive replies over an extended period of time. Perhaps these are just logistical foulups, perhaps they just don't have an answer. But nonetheless, the controller under the UCR form should receive an answer.

Mr. EVANS. All right.

I would like to get your opinion, from your experiences here, in terms of switching from the narrowband to the broadband operation. You stated that the targets on the screen will only be properly displayed on the broadband screen if aircraft codes are changed. This requires an action by the controller. What length of time are we speaking of here in order to make the proper changes in aircraft codes so that these targets will be displayed on the broadband system?

Mr. FOLTZ. On paper, you can give one—as Jim Logan mentioned earlier—you can give one blanket broadcast, "Attention all aircraft, squawk 1100." On paper this looks fine. But a broadcast like this requires no acknowledgement out of the pilot, except to change his squawk. So therefore you are over on broadband, and say three or four are missing—which has been my experience is always happening. Somebody misses your blanket broadcast. So you have somebody out there where you may or may not have a slash on him.

Mr. EVANS. I see. So this will generally result in a response from these aircraft, although there is no way to insure that. What about in terms of changing—I take it you are taking these chips, or shrimp boats, from the narrowband screen, and you are readjusting—they are not actually on the screen itself, on narrowband, but they are displayed on the screen when you switch over to the broadband, is that correct? I mean they are over here alongside the screen during narrowband operation, and you take them off and place them on the screen? Describe that.

Mr. FOLTZ. Yes, sir. In order to do your chips, shrimp boats, they are sitting over here in a little tray, over to your left, say. And they are completely blank, as described. There is no aircraft identification, no altitude, there is nothing written on the scope. You have to manually take a grease pencil and for each aircraft write his call sign and his altitude. We many times compromise on call signs or altitude, as Jim mentioned in his statement, writing something that will just—just to start getting you back into the works, just writing something on that chip and getting it up there.

Mr. EVANS. How long does that take to get these chips displayed on the screen for broadband operation?

Mr. FOLTZ. Once again, depending on the number of aircraft. It probably takes you 10 seconds, 15 seconds to write an individual chip, find the aircraft, and identify him. If you have 25 aircraft, that is quite a while.

Mr. EVANS. That is what I am interested in.

Mr. Chairman, I believe those are the only questions that I have at this time.

Mr. RANDALL. Does the staff have any questions of either of the controllers?

Apparently not.

I want to compliment you gentlemen who have been here and been as forthright and straightforward in your testimony as you have been. I want to say that it may be a case of you sticking your necks out a little bit here, to tell this to us like it is, the way you see it on the front line, or on the firing line. I hope, since we are not going to be around, that there will be no effort to intimidate you or no reprisals. The subcommittee chairman won't be here next year. But a man by the name of Jack Brooks, who is chairman of the committee, will be around. I am sure he would not tolerate any reprisals or intimidation against any of the people who have testified today.

I want to thank you very much.

Mr. LOGAN. Thank you, Mr. Chairman.

Mr. RANDALL. At this time we will call back the people from the FAA and we will have some questions for them.

But before we proceed with questions, the Chair wants to explain why he referred to one of the FAA people as a good guy. It is because of the bangup job that he has done in getting all of these tables together. So we commend and compliment him—Mr. Thompson—for being a good guy.

Mr. THOMPSON. Thank you.

Mr. RANDALL. Now, we have a lot of questions. So get yourselves ready here.

Mr. EVANS. I have a couple of questions for Mr. Patterson which I didn't ask earlier this morning. I would like to find out how many team or area supervisors in your region, the Great Lakes region, have had actual experience on the narrowband radar system before being made supervisors.

Mr. PATTERSON. Mr. Evans, I would have to provide that for you.

Mr. EVANS. If you could, for the record—how many supervisors are we talking about in the Great Lakes region at the control centers?

[The information follows:]

All team supervisors have received training in the narrowband system. Of the 168 team supervisors at the four enroute facilities within the FAA's Great Lakes Region, 62 (37%) were controllers in a narrowband environment prior to becoming supervisors.

Mr. Evans. I also wanted to ask you this, Mr. Patterson: In your opinion does narrowband radar proficiency decline during a controller's absence from the job for more than a few days? Is this a skill that you really have to be on the job day in and day out in order to be in tip-top shape?

Mr. Patterson. Are you still in connection with supervisors, or anyone?

Mr. Evans. No. I am just talking about any controller. Does being on the job have a direct relationship to their top efficiency?

Mr. Patterson. Yes, I would certainly say that the longer you are in there doing it all the time, day after day after day, your proficiency would stay at a higher peak level. However, a couple of days I don't think would make any difference, like if you took a break, or a week's vacation—I don't think that would make very much difference.

Mr. Evans. One last question concerning the controllers and the supervisory personnel. Do you feel that communication between the controllers and the supervisors, supervisory personnel, can be improved, and if so, could you suggest to the subcommittee how we might go about improving communications between the controllers and the supervisors, if you perceive that to be a problem?

Mr. Patterson. First of all, I think communications between the first level supervisor and the controller could always be improved. I don't think we will ever reach the ultimate in communications between any two human beings. I think that the answer to that, if there is a simple answer, would be along the lines of human relations training, interrelationships with other human beings. I think we should and are doing some studies in the area of social effects, effects of the social environment on everyone, including the controller and the supervisor. I think those kinds of areas are the areas that we as an agency need to and are, by the way, putting an emphasis on as far as training of our supervisors.

Mr. Evans. OK.

Mr. Chairman, let me return the questioning to you.

Mr. Randall. Thank you, sir.

First off, you gentlemen have been in the room and have heard the testimony of the two controllers. They felt that there should be a quicker way, mechanically, physically; there should be something that should go right now, with as many things happening as there are out in the air. Would anyone like to comment on what the controllers have said?

Mr. Sharp. Mr. Chairman, I would like to make a couple of comments. One—I found it to be a valuable experience to have an opportunity to hear first-hand the controllers' concerns relating to some aspects of the system and their recommendations for actions that might be taken to improve the system from the standpoint of usability, as they see it.

With respect to——

Mr. Randall. All right—"as they see it." We are going to get back to what is the difference between their seeing it and your seeing it.

Mr. Sharp. I don't know at this point. But I did want to make that comment, because it has been useful and a helpful experience to me to hear these comments. And in terms of the speed-up, one, I think we have mentioned earlier, even though unfortunately it is 2½ years or perhaps 3 years away from implementation here at Indianapolis, the direct access radar channel is a device that we currently have under contract, just recently placed under contract, to provide a better transitional effort. It will provide a display——

Mr. RANDALL. This is the first time we have heard of that contract. Who has that contract? When has that been going on? To get a better transition. You didn't mention that in your prepared statement.

Mr. SHARP. Sorry if I overlooked that, Mr. Chairman. It was awarded to Raytheon Corp. in late September.

Mr. RANDALL. This year?

Mr. SHARP. Yes, sir.

[See FAA news release of Nov. 2, 1976, in app. 1.]

Mr. RANDALL. And what specifically does it do? Oh, this is DARC. You camouflaged it to us here. I see. All right.

Mr. SHARP. Sorry. I tried to avoid the use of the acronym.

Mr. RANDALL. All right. Go ahead.

Mr. SHARP. The DARC, of course, will replace the broadband system and will provide the controller, on demand, with radar target information, including direct identification of the target and other bits of information. It will not be a full system such as we have in the RDP system, but it will provide a display far more nearly comparable to the RDP-type display than the broadband now provides.

Mr. RANDALL. All right. Is that your answer to the controllers—that you are going to try to get a quicker transition, a smoother mechanical transition.

Mr. SHARP. Yes, sir, we are.

Mr. RANDALL. It is in DARC.

Mr. SHARP. Yes, sir.

Mr. EVANS. Mr. Chairman, if I may ask a question. Is there anything that can be done now so long as we are still continuing to operate under the broadband system, until DARC becomes operational 2 or 3 or 4 years from now?

Mr. SHARP. At this point, the only thing I can say that would be of any value—we will certainly investigate what might be done in the interim period. It will be about 3 years here at Indianapolis and a similar time frame for other centers within the system.

Mr. EVANS. So in the meantime, whatever problems develop with the narrowband, the transition over to the broadband, here at the Indianapolis facility, or any facility in the United States, if those problems are brought to your attention, you will investigate and see if anything can be done in the shortrun to correct those problems, until we can get to this DARC system, which hopefully will eliminate many of these problems.

Mr. SHARP. Obviously, as I mentioned earlier this morning, we have a number of things in process, such as more aggressive maintenance of the system, some other activities that we hope to, one, reduce the number of these occurrences, and secondly, we will investigate what might be done to improve the smoothness of the transition from the narrowband to the broadband kind of operation.

Mr. EVANS. All right. And if you could keep the subcommittee posted on your progress, it would be very informative for us.

Mr. SHARP. Yes, sir. We will be pleased to do that.

Mr. EVANS. Thank you, Mr. Chairman.

Mr. RANDALL. Thank you. There is a song from a musical called "Everything's Up-to-Date in Kansas City—we've gone about as far as we can go." We have just learned from the staff that one of the very first uses, scheduled sometime between October 1 and October 4, which is now past, is that there is going to be a DARC modification installed at MKC, which means Kansas City. Is that correct?

Mr. SHARP. Yes, sir. This is in preparation—it is a modification to the computer display channel that will prepare the system to accept the full DARC operation. It is a forerunner or precursor of the total system, one that has to be done at some point prior to the actual implementation of DARC. From the standpoint of operational improvement, I defer to my colleague, Jerry Thompson. But I don't think there will be noticeable improvement in the system. Am I wrong?

Mr. RANDALL. We don't have as many airplanes as you have here. We just kind of stumble around, fall back a step or two. But we are glad to know you are going to do something for us out there in the country.

Mr. THOMPSON. That modification corrects some known problems in the display generator part of the CDC, as well as provides a spigot, if you like, to accept DARC.

Mr. RANDALL. Mr. Locke, we had a question for you. I think the controllers have probably highlighted it or pinpointed it. We were planning to ask you what is the difference between availability and reliability of these back-ups when these outages occur. So we are going to put it in the words of the controllers—the difference between availability and usability. Do you have anything in the nature of a comment?

Mr. LOCKE. Availability is the total time a system is available in terms of hours translated into a percentage factor, through a formula. Reliability, which I guess you could say is synonymous with usability, is more of a quality figure, in which we have a formula where we inject what we call MTBO, that is mean time between outages. This is a mathematical calculation that gives us a better feel for how reliable the facility was, rather than just plain available. I guess I could illustrate that a little more simply by saying a facility could be available many hours a day; but on the other hand, if we had a certain number of interruptions during the day, they could be compressed into a fairly short time frame—we would have a good availability but a rather poor reliability, because these occurrences would be happening in an unscheduled manner in a short time frame.

Mr. RANDALL. You said availability was time, but you never said what reliability was.

Mr. LOCKE. Reliability could be better defined as quality.

[FAA provided the following definitions to clarify the terms "availability" and "reliability." "Availability" is the percentage of time that the system is operating versus the time that it is expected to operate. "Reliability" is the probability that the system will operate during some future period of time—usually the next 24 hours—without an unscheduled interruption in service.]

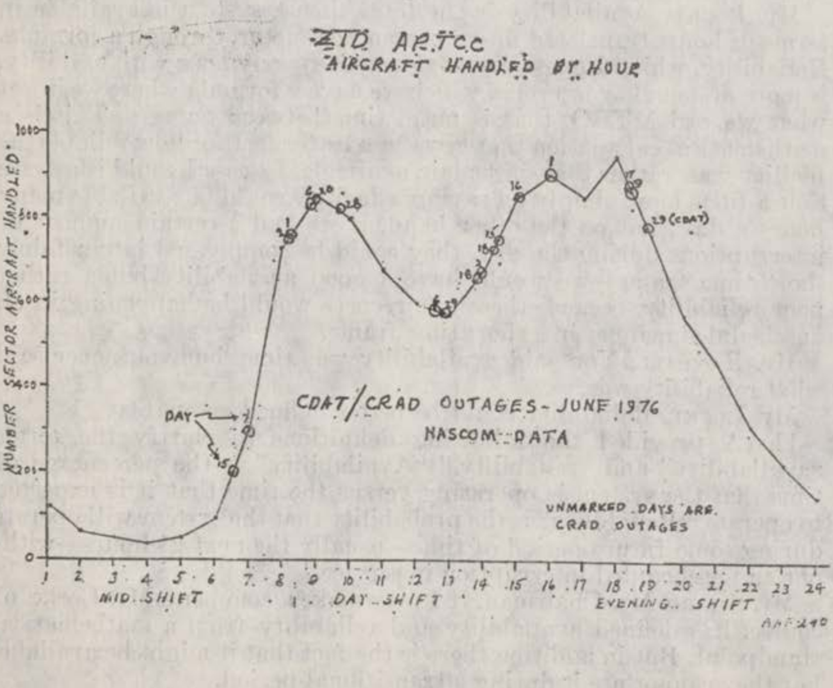
Mr. SHARP. Mr. Chairman, if I may make a comment. Mr. Locke, of course, has defined availability and reliability from a mathematical standpoint. But in addition there is the fact that it might be available but they cannot use it during a transitional period.

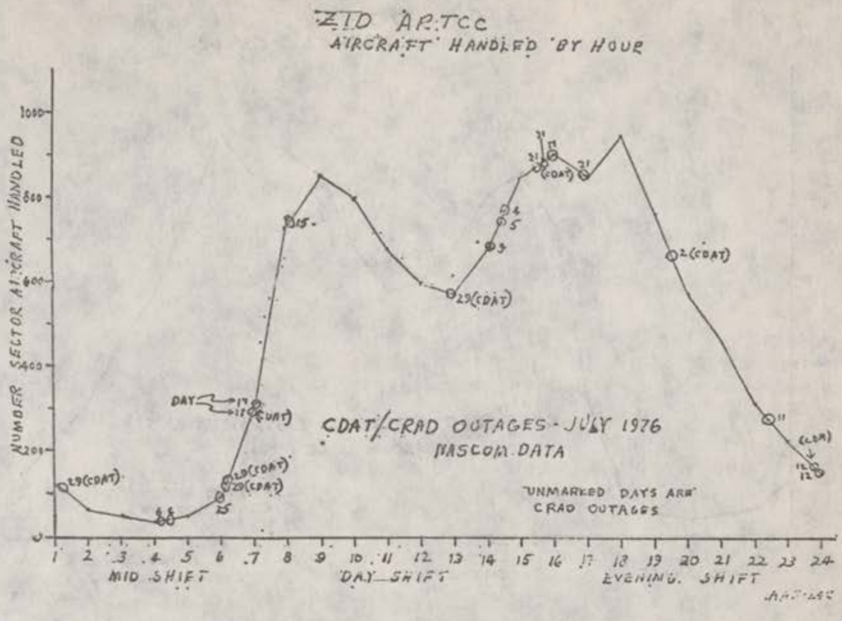
Mr. RANDALL. It is not very much good if it is available and they cannot use it.

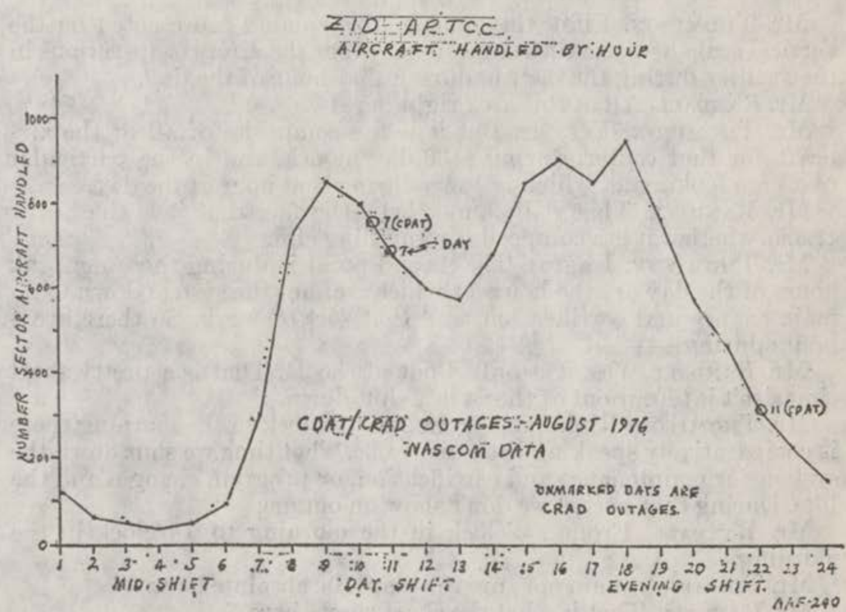
Mr. SHARP. This, of course, involves air traffic control procedures, or the techniques of converting or transitioning from the narrowband to the broadband kind of an operation. And to the extent, of course, that controllers are occupied with the mechanics of adjusting the system, while it may technically be available, they cannot use it effectively in the air traffic control process.

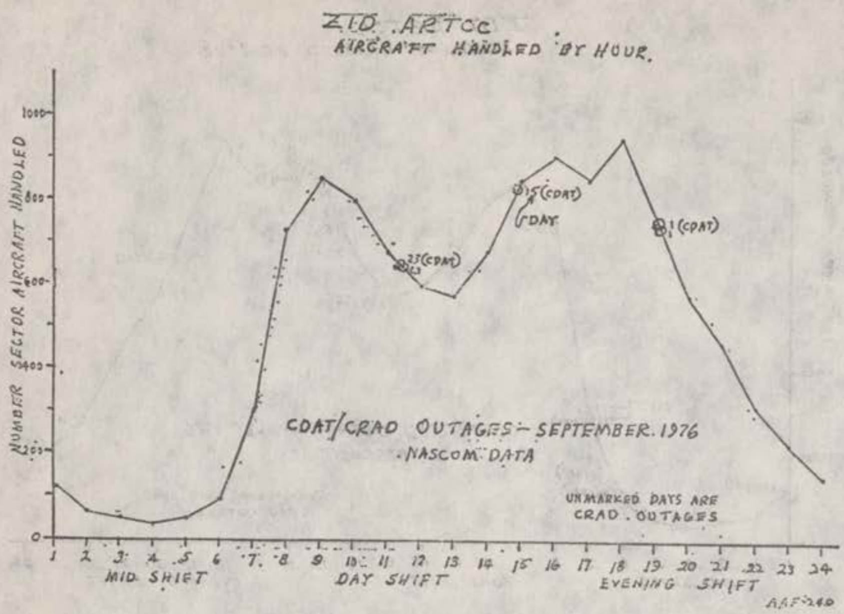
Mr. RANDALL. We have very little time left, according to the commitments we have here. We get back now to Mr. Acri. You have done a good job, Mr. Acri, in charting this thing. Or maybe this goes to Mr. Thompson. You have a "Z" in front of it with a line in front of it, and "ID"—that means Indianapolis, I guess. This is what we were talking about a minute ago. You did have a special log with the interruptions. You have a log of these interruptions and outages. Mr. Evans did a good job in questioning. You broke it down into all sorts of timetables—3 seconds or less, 4 to 59, and then a minute or more, on computer operations. But somebody else has a chart here—this is the one where on the left side of the scale we are talking about the number of flights, and down here we are talking about the time of day. We get up here on these peaks, and all these little circles, the ones indicating that the thing went out. What do you have to say about the situation where when the number of flights increased way up to these peaks, and none of them are below 600 flights in the air at one time—down here where you are talking about 200 or 100 everything is working perfectly. Why does this contraption go out when it is needed the most?

[The graphs referred to follow:]




ZID ARTCC
AIRCRAFT HANDLED BY HOUR
NUMBER SECTOR AIRCRAFT HANDLED
CDAT/CRAD OUTAGES - JULY 1976
NASCOM DATA
UNMARKED DAYS ARE CRAD OUTAGES
MID SHIFT
DAY SHIFT
EVENING SHIFT


ZID ARTCC
AIRCRAFT HANDLED BY HOUR
NUMBER SECTOR AIRCRAFT HANDLED
CDAT/CRAD OUTAGES - AUGUST 1976
NASCOM DATA
UNMARKED DAYS ARE CRAD OUTAGES
MID. SHIFT
DAY. SHIFT
EVENING SHIFT.
AAF-240




Mr. Thompson. First, the number of airplanes represented on the vertical scale here are the composite of all of the aircraft operations in the facility during the month, during that hour of the day.

Mr. Randall. All of this area right here?

Mr. Thompson. Yes, sir. But it is the composite of all of the aircraft for that center, during a 30-day month, and in the particular one I am looking at, which is June, during that hour of the day.

Mr. Randall. That still cannot belie the fact that it is the heavy traffic, whether it is a composite or anything else.

Mr. Thompson. I agree. The second point is during those nonpeak hours of the day are the hours at which we shut the system down to do maintenance and certification, and that sort of work. So there are 4 hours during——

Mr. Randall. Yes, it is only 4 out of the 24. That is a pretty short time, isn't it? Four out of the 24 it is shut down.

Mr. Thompson. Right. But from 2 to 6 o'clock in the morning there is comparatively speaking little air traffic. That time we shut down the system for maintenance and certification, or program changes and the like. During that period we don't show an outage.

Mr. Randall. From 2 o'clock in the morning to 6 o'clock in the morning.

Mr. Thompson. I am not sure those are the absolute hours.

Mr. Randall. That is what the chart shows here.

Mr. Thompson. So there will be no outages shown during that period because it is shut down anyway.

Mr. Randall. Well, there are no outages shown, not very many, from 6 o'clock until about 8 o'clock, along in there.

Mr. Thompson. I understand that. As a matter of fact, if you look only at June, it would appear that the major outages occur between noon and 1 o'clock in the afternoon, maybe as far as 3 or 4 in the afternoon.

Mr. RANDALL. You get down here to 1400 hours, which is 2 o'clock—you still get pretty bad on up here to 1900 hours, which would be 7 o'clock, is that right?

Mr. THOMPSON. Yes, sir. Now, if you will note July, the sheet that follows, the change is somewhat different here. You will note now they show up early in the day, and particularly during the bring-up time, and again somewhat in the afternoon. In other words, immediately following 6 in the morning, as well as 1, 2, 3 o'clock in the afternoon. And then if you look at August——

Mr. RANDALL. You mean to say there were no outages at all?

Mr. THOMPSON. There were 3 outages in August.

Mr. RANDALL. There were outages in August, then.

Mr. THOMPSON. Three.

Mr. RANDALL. As a matter of fact, there are outages in September, too.

Mr. THOMPSON. Yes, sir.

Mr. RANDALL. September is the last chart you have given us. Obviously that is the last full month involved.

Mr. THOMPSON. Yes, sir. The point that I would like to make here is while June's data looked like the traffic count had something to do with the machine's reliability, the subsequent data that we have looked at would tend to disprove that point.

Mr. RANDALL. I would be interested to know how you can disprove a chart that you submitted and presented yourself.

Mr. THOMPSON. I am not suggesting the chart is inaccurate, sir. I am saying that taken over a longer period of time, it doesn't appear that all of the outages appear at the highest traffic count.

Mr. RANDALL. You mean sometime before you started preparing the chart things were better and hopefully they will be better in the future.

Mr. THOMPSON. No. I am saying if you look at the data in each of the months, there is some doubt in my mind that the traffic count—that there is a direct correlation between the traffic count and the hour of day, and the computer outages or the frequency of computer outages, outside of there not being any in the time in which we shut it down.

Mr. RANDALL. You are saying if you look at the whole picture, if you take them way down to the extreme edges of the chart, that there is no correlation between peak traffic and outages.

Mr. THOMPSON. That is what it appears to me from what I have seen thus far.

Mr. RANDALL. I must respectfully say to you maybe that would be all right for September—but it is certainly not true for July, because all the little circles are up where the traffic is the highest, and it is certainly true, quite apparently true in June, all of them are up where the traffic is the highest. So we don't get much light at the end of the tunnel until we get down to August, where it is really the only good month you have had. And then you get back in trouble again in September, where you get up with 800 planes, and that is where all the outages are.

Mr. THOMPSON. That is true. But there are only four outages in September, sir. I don't want to appear argumentative.

Mr. RANDALL. You are right about September. So you are making a little progress then.

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Mr. THOMPSON. I think so. Also, the highest correlation of outages to time of day thus far, for all the data I have looked at, is right after the startup, right after we come up in the morning. Now, that not only includes the data you see here——

Mr. RANDALL. You have some when you come up. But you cannot say in June and July that 1400, and even up until 5 o'clock, 1700 hours, you are just starting up.

Mr. THOMPSON. I agree with you. Particularly during June and July it appears——

Mr. RANDALL. Bad time, June and July.

Mr. THOMPSON. Yes, sir.

Mr. SHARP. Mr. Chairman, if I may interpose a comment. The plotting of this data was one of our efforts in trying to correlate or relate any known physical occurrences or aircraft traffic or any other data that might impact on the system with what causes the errors.

Mr. RANDALL. Thank you for this effort, because without that we would be just as much in the dark as these controllers are when this thing goes blooey. We appreciate these reports. And that is why we are going to try to get you to report a little better and more often. These charts are a good thing. I don't know where the staff got these charts.

Mr. SHARP. Mr. Thompson prepared them and presented them to them, as one of our efforts to try to identify any physical phenomena, time of day, traffic, with outages. And so far they are not statistically significant, or at least not determinative.

Mr. RANDALL. Well, it is just about time for us to adjourn. We have a lot more questions of the FAA. But our time is about gone.

Mr. Evans, do you have some final questions?

Mr. EVANS. One question—given the last few moments here.

How much testing is done at night here at the Indianapolis center, Mr. Acri?

Mr. ACRI. I could not answer that. I would have to give that to Nelson Locke. As far as testing on the 4 hours during an outage?

Mr. EVANS. Yes. Would that not come under your jurisdiction out here, Mr. Acri?

Mr. ACRI. Pardon?

Mr. EVANS. You are with Air Traffic. And we would have to ask someone with facilities, is that correct?

Mr. LOCKE. If I may answer. The testing activity starts almost immediately with shutdown, and it involves doing maintenance activities that cannot be done with the full system on. There is a software activity that is generally taking part of the time involving analysis and adaptation of software programs. If we have had an error readout during the day, we might have an expert in specially to analyze the program and simulate it and analyze it during this off-time period, when we can get the total system. It is a very busy period of the day.

Mr. EVANS. OK. So this is normally an activity that is engaged in at really each of the air traffic control centers, each night.

Mr. LOCKE. Every one of them. It is routine for every facility.

Mr. EVANS. I see. I think that was the only other question that I wanted to bring out at this time, Mr. Chairman.

I want to express my appreciation to you for the work that you have done as the chairman of this committee. I am sure our work will continue, although certainly without your expertise.

Mr. RANDALL. Mr. Tempero has a question or a comment.

Mr. TEMPERO. Thank you, Mr. Chairman. Very quickly, the FAA should be generally complimented on their approach to this hearing. On the whole you attempted to assist us in every way possible when we asked for information such as that furnished by Mr. Thompson. Your briefings in both Leesburg and Indianapolis, were complete and you attempted to be candid and responsive to the questions asked.

I would, however, like to give you a litmus test of what one person believes this hearing has shown and what it has not shown. What it has not covered is an area the FAA should carefully review.

There isn't much question about air space safety when the narrowband system is operating, nor much question about safety after you have transitioned to the broadband system, nor much question about the safety after you have transitioned to the manual system, though the fact is you cannot handle as much traffic in the manual system as on the other systems.

There also isn't much question about the efforts being made by airway facilities in attempting to improve the mechanical part of system interrupts. It is, frankly, a very awesome—as a noncomputer expert—experience to walk into the computer room in these facilities. There is an incredible amount of hardware and one wonders how they continue to function at all, let alone function in a very credible way.

But after listening to your testimony today, the following questions hit me.

Why, though there was discussion on the mechanical problems of the transition, was nothing said regarding the human problems of transitioning from system to system? From narrowband to broadband to manual?

Why is there absolutely no acknowledgement of what appears to be the potential Achilles' heel of the entire system? And, assuming there is no derogation of safety, certainly your testimony indicates this is potentially the system's weakest link. Yet, we continue to be told that, no, there is no derogation, we continue to be told, no, air space safety is absolutely as good during transition as any other time. And frankly, I think that flies in the face of credible testimony today.

Why, in a discussion of the problems of system interrupts was there no discussion of the human side of the problem? You managed to reach the human side in the last sentence of the last paragraph on the last page of your testimony, when you said, "I don't want to ignore one last ingredient in the formula . . ." and then gave the controllers their due.

Why is there no specific controller training for the transition period? There appears to be none in Oklahoma City. Now, one might logically argue that is not the appropriate time for it. If so, however, why is there no simulation in the facilities of it? Why is there no actual sitdown and go through the kinds of things that have to happen? Then at least it would not be a total surprise that comes about.

Lastly, I would recall for you the language the chairman read from the NTSB report earlier in the hearing.

> Based on the high percentage of human failures in the Air Traffic Control System, the Safety Board believes that as long as the human element is a part of the total system, an individual's level of competence, the quality of his per-

formance and his understanding of his primary responsibilities must be given as much managerial attention as the equipment he operates.

Yet today, when the FAA talked about system interrupts, we heard about the equipment, its component parts, and the corrective actions being taken to it; and nothing about any managerial efforts being given to the controller himself on how he should cope with the problem.

It is not to say there has been nothing done. But it is clear that when we investigated the problem, we were focused on, and you are focused on, the equipment rather than the people. It is clear people are an integral part of the whole system. They must be taken into the FAA's thinking.

Thank you, Mr. Chairman.

Mr. RANDALL. Thank you, Mr. Tempero. I don't know how you can summarize what we have heard this morning any better than that. The Chair had planned to ask if the FAA is afraid to say that the system sometimes has a lower efficiency and to concede that safety is affected. Or do they continue to say that a system interruption does not pose a hazard to aviation safety?

That is an excellent summary, Mr. Tempero.

Again, I think the key to this is what you are going to do. We don't have anybody here this morning and this afternoon from the really top-level traffic people. We have had the facilities people. And that is what the emphasis has been on. But there is no way you can top what Mr. Tempero has said, as to why there is no training in this transition. I tried to pry this out a while ago. Going back to the language of the National Transportation Safety Board—why is it that management does not give as much attention to the human element, managerial attention to the controller himself, as they do to all the equipment and facilities.

I think we have had a productive session.

We are not going to be around next year. But there just has to be some training for this transition.

These fellows here at the table a while ago talked about the concern and anxiety they are put through. I have never questioned the interest and concern that our controllers have for the lives of those people in the air. You have heard what they have told us. I think the very least that the FAA could do would be to take charge of this thing, follow the admonition of the National Transportation Safety Board, and give some training in this transition immediately. I suppose you cannot get the equipment to the stage where it is foolproof. But let's do the best thing and get them ready for the transition situations.

Well, we are way over our time.

Mr. SHARP. Mr. Chairman, if I may make a comment. I understand that you are voluntarily retiring after your current term of office is completed, and this may be your last year as chairman of this subcommittee. I would like to take this opportunity to express the appreciation of the entire agency for the attention and thoughtfulness that you have given to the agency in the various hearings that you have conducted with it to assist us in doing a better job. While we will still be looking forward to working with you and your subcommittee, I did want to make that point, because it has been a valuable contribution to us.

Mr. RANDALL. Our gratitude to you for your kindness. I want to say to you we never had any real grievance against the FAA. We are simply trying to improve the safety of those who use the airways. That is what all of our hearings have been about. Thank you very much.

At this time the Chair requests as unanimous consent that the record be held open for some of the controllers who may wish to put in statements. Is there objection? Hearing none, it is so ordered.

At this time, the subcommittee is adjourned.

[Whereupon, at 2:10 p.m., the subcommittee adjourned, to reconvene subject to the call of the chair.]

# APPENDIXES

## Appendix 1.—Written Statements Submitted by Air Traffic Control Specialists at the Air Route Traffic Control Center, Indianapolis, Ind.

October 15, 1976

On September 16, 1976 at approximately 1400Z the ZZV Radar controller attempted to contact CLE center controller to ensure aircraft #1 was only cleared to 12,000. CLE center was already trying to stop aircraft #1 at 12,000, but was unable to because they had lost their frequencies (120.4 379.1). It was later learned that they lost a number of frequencies and they were out most of the day. We know they had to combine the HLG and ATW sectors the rest of the day due to frequency problems. Aircraft #1 did not receive clearance to maintein 12,000 and the ZZV radar controller had aircraft #2 eastbound at 11,000. Initial tracts of targets indicated that there would be no less that five miles and perhaps as much as seven miles separation. Shortly after aircraft #1 had entered ZID airspace, the projected separation between the two aircraft decreased to where there was questionable separation when the two aircraft passed. A ZID supervisor questioned the separation and reported the incident as a systems error. The CLE radar controllers advised the ZZV controllers that the aircraft never appeared any closer than five miles.

The ZZV radar controllers suspected aproblem with the ZID RDP system. Upon trying to investigate the problem the management at ZID would not offer any information or assistance.

The suspected problem was reported on 9/16/76 but as of 9/20/76 no evidence of any corrective action had been taken what so ever. There was not even as much as a warning about the radar to any controller.

On 9/20/76 the ZZV radar controller completed a UCR (307474) stating the problem and unless something is done to correct the problem, it could occur at anytime.

The suspected problem was that targets became displaced as much as 1.8 miles when changing from a London radar sort box to a Pittsburgh radar sort box.

On 9/22/76 the ZZV radar controller observed another controller at ZZV vectoring two aircraft at 8,000 in the suspected problem area. There was a verbal warning given and shortly thereafter, with the aircraft having eight to ten miles separation between them. Both targets became uncorrelated and jumped four to five miles, and at times showed as many as four live targets on radar. The area supervisor was called to the area immediately and for the remainder of the day witnessed such target jumps. The same controller that turned in UCR (307474) at this time turned in a local Unsatisfactory Status Report to the area supervisor, who in turn advised the automation department and the assistant chief on duty.

It is unknown to the controller what action was taken at that time, but as of 9/24/76 no warning had been given to any controller that the problem still existed and no known corrective action had been taken.

On 9/23/76 the three ZZV controllers that were involved in the incident had to appear before a systems error review board to prove that they had not committed any control errors. The controllers presented to the board copies of the UCR and USR aforesaid in this letter along with other eyewitness reports which were provided by the area supervisor.

Had not the controller taken the initiative to compile the evidence, we feel almost certain that the FAA would never have made known the problem to the systems error board.

Documents are available to substantiate this letter..

Sincerely,

Kenneth Cornelius, ATCS

At approximately 2130z on October 14, 1976, I was working York Lo altitude radar sector. Lynch radar site was notamed out of service from October 14, 1976 0600oz until October 15, 1976 1800oz. With this system out of service I was forced to work part narrow band and part broad band radar. Traffic conditions were light to moderate and under normal conditions I could have worked the sector with ease, however because of a keyboard outage on the narrow band system I could not make normal entries into the computer. I had to request a tracker just to talk to approach controls while I kept up with the aircraft on the broad band radar. Many of the aircraft had to be changed to Code 1100 so I could see them on the broad band radar. About 5 or 10 minutes after a supervisor was notified maintenance brought a new keyboard down, however it was the wrong keyboard and he had to return for the right one, this of course caused more confusion and delay. When the maintenance man returned with the right keyboard he had to shut off the power to my narrow band scope, I was left with a broad band scope in the upright position with three arrivals into the Columbus Airport no altitude read out plus other aircraft in my sector that I am controlling without chips to flight follow them. I had to again change codes and continually ask aircraft for their altitude to separate them adequately.

This is a classic example where a completely routine situation turned into an unsafe situation by an outage of the narrow band radar.

Larry D. Wilburn,
Radar Controller, Ind ARTCC

October 17, 1976

On September 23, 1976 I was working the Wabash Super Hi Position, when there was an outage of not only the RDP but the frequencies and broadband radar. Fortunately the failure was in the "PCS" (Power Conditioning System) and the broadband and frequency outage was only for a few seconds. This power outage caused the computer to "Flop" for minutes.

The PVD was out of its track and for this reason could not be lowered into the horizontal position for broadband operation. This prevented me from "Reverting to broadband operation".

I was lucky there were only two flights on frequency at this time and due to the lack of traffic these could be easily monitored with the PVD in the vertical position. Had I been busy this would have been impossible.

When the RDP fails the situation is always one of confusion, if not panic. The change to broadband usually takes from two to five minutes (rather than "instant") and there is a reluctance on the part of controllers to transition because there are so many "Blinks" or momentary outages, a controller will wait for a short time in the hope RDP will quickly return.

Once in broadband operation the return to narrow band (RDP) takes just as long (two to five minutes usually) if a controller is very busy these transition times could take as long as thirty minutes of confusion.

Keith Schupp
ATCS Indianapolis ARTCC

In rebuttal to the agencys contention that RDP blinks and outages do not constitute a safety hazard, I would like to report an episode from personal experience. The exact date and call signs of the aircraft would be impossible to recall, but I do believe my point will be made by a description of the situation. I also believe that aircraft safety was reduced as a direct result of the equipment malfunction.

The incident involved a northbound aircraft on J89 vectored behind a westbound aircraft on J134. It was a tight vector which was going to result in about five to seven miles. At the time the westbound was twelve o'clock to the northbound, the RDP blinked about three or four times in rapid succession. After suffering a slight heart failure, I quickly transitioned to broadband radar, only to find that I could paint only the westbound. By the time the code of the other aircraft was determined and placed in the decoder, the northbound had passed about five miles behind the other aircraft. Had the westbound jetstream been unusually strong or the initial vector not been sufficient, the time normally used to determine this was consumed doing things not normally required. This could have easily resulted in less than minimum separation, thus jeopordize aircraft safety.

Fortunately, the broadband radar was giving a sharp display at the time expediting matters somewhat. But there was about ten seconds where I did not know what separation existed between two aircraft at the same altitude, particularly during an imminent situation. The difference in the display between RDP broadband intensified the problem of determining their relative positions.

This situation occured approximately six months to a year ago, and was not formerly reported. However, I believe now, in view of the agencys stand on the importance of radar outages, this incident will prove itself germain to the proponents of aviation safety.

Bruce Awishes

Bruce Awishes

I cannot remember the exact date of this particular computer outage, but the results are still very vivid!

About 5:30 in the evening I was working the Somerset High Altitude Sector. When this particular RDP outage occured, I was working twelve to fifteen aircraft on my radar scope. Three aircraft were on vectors, and two aircraft were climbing to their assigned altitude which would take them through other aircraft assigned altitude. The radar scope went blank and there was no immediate problem. I waited two minutes and the radar still did not return. I became concerned about the radar retruning and the fact that the aircraft that I was separating had now traveled 16 to 20 miles. I needed to know how effective my vectors were and also the altitudes of the two climbing aircraft. I attempted to revert to the broad band radar but to my surprise the broad band radar was not operating either. With no radar I could only assume where the aircrafts positions were. I immediately went to the Memphis Center controller and had him expand his range on his radar, identify my aircraft, and insure that separation existed. After this insurance I went to the controller north of me and repeated the same procedure for two additional aircraft in confliction.

The climbing aircraft I stopped at different altitudes that I knew were not occupied by other aircraft. The situation was such that manual separation could not be applied. I stopped all air traffic from entering my area.

The total duration of the radar outage was;

1. Broad band - 15-20 minutes
2. Narrow band - 45 minutes

Situations such as this leaves the controller nearly helpless in periods of complex traffic.

Willie L. Haynes

Willie Haynes

While working the Indianapolis High Altitude sector I experienced an RDP outage.

At the time the outage occured I was working approximately nine aircraft. One of the aircraft was a military F100 off of Springfield, Illinois filed via J80 climbing to flight level 270. One of the other aircraft was an air carrier filed O'Hare J73 Nashville climbing to flight level 290. At the time the RDP failed the aircraft were told to squawk Code 2100. I could not get a beacon return or a primary return on the military. This made it necessary to use DME reports on the military aircraft, and caused my attention to sway from the other aircraft on frequency. This could have been a potentially dangerous situation.

Thomas Ellis

THOMAS ELLIS

October 15, 1976

To Whom It May Concern:

I have witnessed many computer flops while working as an air traffic controller, but to relate all would mostly be repititious. One, however, stands out foremost in my mind, and occurred approximately six months ago.

I was working the Charleston High Altitude manual position at about the time of the evening rush when the computer flopped without advance notice. The radar controller was working more than twenty aircraft at the time. The next thirty minutes were complete chaos. The radar controller was completely lost and screaming for help. There were numerous targets that were not identified. Almost ten minutes after the radar had been lost, I heard the radar man tell an aircraft to stand by, that he had two aircraft that he could not locate. There were unidentified targets that were crossing our sector boundary, both entering and leaving. Many of these unidentified targets were overlapping. I personally was shaking and terrified as I watched this episode. As soon as the radar controller was relieved from his position, he took sick leave and left.

Remarkable, there was not an air disaster on this occasion. It was impossible for the radar controller to apply planned separation standards.

GERHARD REDER

Air Traffic Control Specialist, GS-2152-13

The transition from an automated Radar failure, to a non-automated environment certainly could not be described as safe, positive, orderly, or rewarding.

When working busy traffic, it is a difficult task to keep aircraft separated, provide a service as much as feasible and to keep the operation safe. Throw in a couple of variables such as weather and flow control, and a person is nearing his limit. Then the radar fails! Chaos enters the situation instantly. Fighting off panic for the first few seconds is very difficult. The service you were providing just went, along with the orderly, safe and positive control.

Looking at the non-automated radar, trying to retain as much of the mental picture as possible. Broadcast blanket beacon code change and hope every aircraft will hear. The usual procedure would be to resolve any impending separation problems and to re-identify the aircraft.

The volume of aircraft will determine the priorties. Separation is number one.

The complexity of the situation has a great deal to do with the transition. Several climbing and descending aircraft through the altitudes of other aircraft is monitored on the automated radar. When it fails there is only a few alternate methods that can be used to attain instant, eventual, legal or just separation.

What this radar failure does to a controllers mental and physical out look can only be felt and measured by the person it happens to.

It happened to me.

Leon E. Dilley

Leon E. Dilley

October 15, 1976

To Whom It May Concern:

As an Air Traffic Controller, I have witnessed several computer failures. Those that I remember best occurred when I was working one of thr radar positions. Because I have been medically disqualified from active control duties for about 4 months I must summarize these outages from memory.

Momentary interruptions of one minute or less were very common and would occur several times per shift. These interruptions were very damaging when the traffic volume was moderate or heavy, or during situations when minimum separation was being used between two or more aircraft. Confidence in your equipment is an essential part of air traffic control and these interruptions shattered that confidence.

Interruptions lasting more than one minute, while not as common, still occurred much too often. Any lengthy interruption requires several snap decisions on the part of the radar controller. The first decision is either to wait out the interruption or to revert to the backup broadband radar. To provide continuous radar service, the backup system must be used immediately. Once on broadband all aircraft transponder codes must be changed to the appropriate stratum code and re-identification made if necessary. If you are working moderate or heavy traffic, the scope must be immediately lowered and target markers made for all aircraft. Then, before returning to RDP radar, it must be ascertained that the system is reliable and will not flop again when the scope is returned to the upright position. To say the least, this situation is very chaotic and violates several rules. When radar service is interrupted, the controller must be able to revert to non-radar separation immediately, and this is impossible.

One specific incident that comes to mind occurred approximately 6 to 8 months ago. I was working a radar position during light to moderate traffic conditions. The super-high position controlling the airspace above my sector was very busy and had the tracker position manned. The entire radar system went into coast without warning, but the system was not alerting us to that fact. Update information was not being posted. After approximately one or two more minutes the entire system stopped functioning, again without indicating "display frozen". I became aware of the malfunction when the super-high radar controller exclaimed that something was wrong. The control room then became a scene of mass confusion. During the process of reverting to broadband radar, I observed the auper-high radar controller become very

Page 2-
Computer Failures
James B. Dawson
October 15, 1976

excited while he was trying to separate a climbing and a descending aircraft that were head-on. I observed the targets on his radar scope and realized the situation was very critical. Because of additional traffic, only one of the conflicting aircraft could be turned; however, because of the close proximity of the targets, both aircraft should have been turned. I was unable to offer a lower altitude because of my own traffic. During the ensuing scramble, I had to devote my full attention to my duties and did not observe the two aircraft pass.

I was very shaken from the incident. To the best of my rememberance, the super-high radar controller took sick leave as soon as the RDP recovery was complete and he could be relieved. I do know that he had been terrified, and even after the incident was in a highly agitated state. I strongly believe that situations such as this contributed to my being permanantly medically disqualified.

James B. Dawson

James B. Dawson
ATCS GS-2152-13

OCTOBER 16, 1976

TO WHOM IT MAY CONCERN:

ON FRIDAY SEPTEMBER 24, 1976 I WAS WORKING THE BECKLY HIGH ALTITUDE RADAR POSITION. AT APPROXIMATELY 1950 GMT AA249 CALLED ON FREQUENCY. I DID NOT SEE A DATA BLOCK ON AA249 AND ASKED THE TRACKER WHO AA249 WAS AND HE TOLD ME HE HAD ACCEPTED A HANDOFF ON AA249 FROM WASHINGTON CENTER. WE THEN REALIZED THAT THE DATA BLOCK HAD DISAPPEARED. THE TRACKER THEN RESTARTED A TRACK ON AA249 WHO WAS PROCEEDING FROM LAGUARDIA VIA J42 TO DALLAS.

A PROGRAM TROUBLE REPORT WAS FILED WITH THE AUTOMATION SECTION AND SHORTLY THEREAFTER A DATA SYSTEM SPECIALIST CAME TO THE SECTOR TO INVESTIGATE. DURING OUR CONVERSATION THE SPECIALIST ACKNOWLEDGED THAT THIS PROBLEM WAS REAL AND THE DATA SYSTEMS PEOPLE WERE AWARE OF IT. THIS WAS THE SECOND TIME A DATA BLOCK HAS DISAPPEARED FROM THE PVD IN THIS SECTOR WHILE I WAS WORKING THE RADAR POSITION. NO EXPLANATION HAS BEEN GIVEN AS TO WHY THIS OCCURED OR NO INDICATION THAT THE SITUATION HAS BEEN CORRECTED.

THERE IS A DEFINITE SAFETY RISK INVOLVED IN USING THE NARROW BAND RADAR WHILE SITUATIONS LIKE THE ONE ABOVE OCCUR. FOR INSTANCE, JUST PRIOR TO THE DATA BLOCK DISAPPEARANCE, I HAD ISSUED A THIRTY DEGREE TURN TO THE RIGHT TO AN EASTBOUND AIRCRAFT TO VECTOR IT BEHIND A NORTHBOUND AIRCRAFT AT THE SAME ALTITUDE. THE PILOT TURNED TO A HEADING OF 030 RESULTING IN A SIXTY DEGREE TURN IN THE WRONG DIRECTION. I QUERIED THE PILOT OF THE EASTBOUND AIRCRAFT AND HE VERIFIED HE HAD TURNED THE WRONG DIRECTION AND APOLOGIZED. I THEN HAD TO TURN THE NORTHBOUND AIRCRAFT AND ISSUED A CLEARANCE TO DESCEND TO A LOWER ALTITUDE AND INSTRUCTED THE PILOT TO EXPIDITE HIS DESCENT.

THE SIGNIFICANCE OF THIS SITUATION IS THAT IT OCCURED WITHIN THIRTY MILES OF THE POSITION THE DATA BLOCK HAD DISAPPEARED ON AA249. THE ALTITUDE I DESCENDED THE NORTHBOUND AIRCRAFT TO WAS FLIGHT LEVEL 350, THE SAME ALTITUDE AA249 WAS FLYING AT. HAD THESE TWO SITUATIONS OCCURED AT THE SAME TIME THE RESULTS COULD HAVE BEEN DISASTEROUS.

A FURTHER EXAMPLE OF THE IMMINENT DANGER RESULTING IN THE LOSS OF A DATA BLOCK IS A SYSTEM ERROR THAT OCCURED ON JULY 11, 1976. AT THE TIME THE SYSTEM ERROR OCCURED I WAS CONTROLLING TWENTY FIVE AIRCRAFT. IF JUST ONE OF THE DATA BLOCKS HAD DISAPPEARED OR THE NARROW BAND RADAR HAD FAILED, I SHUDDER TO THINK OF THE POSSIBLE RESULTS.

Chester K. Groce
CHESTER K. GROCE
AIR TRAFFIC CONTROL SPECIALIST
GS-2152-13

On September 29, 1976 while working a day shift at Indianapolis ARTCC, there were two RDP failures of considerable duration. The first outage occured early in the shift. We received notification that the RDP would be out for one to two minutes which at the time was tolerable. After the two minutes were up and the "down time" was actually approaching the five minute mark, we inquired as to why we were still down and how much longer it would last. Traffic was building and we were without sufficient staffing to work with trackers.

I helped the radar operator lower the scope to the horizontal position and did what I could to do some of the duties of a tracker: make chips, and take and make handoffs. I was actually working the manual position, but felt that helping the radar man was more important than my normal manual controller duties; consequently I got behind in those duties.

Fortunately, both the radar controller and myself are ten year controllers here at Indianapolis ARTCC and were able to maintain a safe operation through maximum effort. However, we did have to shut off auto departures from Indianapolis Approach Control to keep our heads above water. If the "blink" would have lasted only one or two minutes, we would have had no trouble at all and would not have had to shut off departures.

I believe that RDP is without doubt a superior radar system. But even though I am also experienced on broad band radar, I work in constant concern that the RDP will "blink" at a critical time and there will be no time to revert to Broadband, with severe results. The "blinks" and "display frozen" periods have got to be reduced considerably for the RDP system to be operated at the highest possible degree of safety. Controllers with little or no experience on Broadband Radar on a day like Septemeber 29th, with even moderate traffic and RDP outages of up to one hour could be in very serious trouble.

Ronald E. Keller

Ronald E. Keller

I feel that the "blinking" of the RDP system is a definite hazard to aviation safety. There is no doubt in my mind that only by the grace of God and a "big sky" there has not been a tragic incident during the chaotic seconds or minutes of an unscheduled "blink." With the RDP failing during periods of moderate to heavy traffic, there is no means of a smooth transition to the Broadband system. It simply amounts to the controller struggling with all his might to perform all the tasks necessary for the transition in due amount of time, and hoping (even sometimes praying) that he has not forgotten just one single item pertinent to the traffic situation involved. Anyone that says a smooth transition is possible from RDP to Broadband during moderate to heavy traffic periods is ignorant of the system. And most assuredly, is not one who himself controls traffic or has been directly involved in one of these situations.

I have been working many times when a "blink" occured and there was nothing but sheer pandemonium existent on the control platform until the change over was completed. It has also happened several times, that I can recall, that a "blink" occurs which lasts seconds into minutes. Then just when all the controllers get situated under the Broadband we are told the Rdp is useable. So we convert back to RDP followed shortly by more "blinking." This is a most severe hazard to safety and should be corrected immediately before our entire population is reading about the tragic incident that occured during a "blink" in the world's most sophisticated radar system.

I am more than willing to elaborate on the terms used in the above statement to anyone who is interested in aviation safety, Reevel and consurrently interested in correcting the deficiency of our present system.

Edward R. Roever

The Narrowband Radar System was implemented, at considerable expense, to reduce controller workload and enable the controller to handle a greater number of aircraft. During the testing and evaluation phases, many problems were uncovered, some of which have been satisfactorily resolved. However, problems still remain that prevent the controller from totally utilizing this multi-million dollar syste. I am referring to the reliability of the system itself.

There is a general feeling among controllers, myself included, that when the system is most needed, it will fail! This opinion is based on past experienced and my knowledge of system capability. For example, the 9020 computer is programmed to drop certain information in order of priorities when the system becomes saturated. To my knowledge this has never happened at Indianapolis; maybe because the system failed long before that saturation point was reached.

With these thoughts in mind, consider a typical IFR-type day, with low ceilings, poor visibility, and presence of frontal activity and thunderstorms. It is not unusual to be working 10-15 aircraft at any given time under these circumstances, with traffic surges of up to 20-30 aircraft, many of which could be on radar vectors for weather and traffic.

Consider then the radar controller who is responsible for the safety of hundreds of people, while tucked away in his mind is the thought that the system could fail any second without notice. This situation places the controller under pressure and stress. The aircraft utilizing the services of air traffic control have confidence in us. FAA management, I feel, has confidence in the people who control traffic. That places the controller squarely in the middle when he does not have confidence in the system at present.

Let's talk about the "back-up" radar systems. At Indianapolis 5 radar sites are utilized in the narrowband mode. However only three sites give broadband coverage, and much of that is limited at the fringe areas. The fringe area in one case is an entire sector, where Broadband radar is unuseable below 10,000 feet, depending on weather conditions. So for some of us, there is no "radar back-up."

While utilizing the Narrowband Radar, aircraft are assigned "discrete" codes because of the computer requirement in the tracking mode. Many of these codes cannot be seen on Broadband Radar due to the limited number of codes available. Hence, the biggest problem in transitioning from Narrowband Radar to Broadband is one of recoding.

The Narrowband outages and the transition to the "back-up" has been described by some as "annoying" or "minor inconvenience" and as "instantaneous." That simply is not true. It is true that Broadband Radar may be selected at the push of a button, but that is only the beginning.

First all aircraft in your sector must be changed to a code available for Broadband Radar. Secondly, re-identification of each aircraft must be accomplished to assure positive identification and a target marker (shrimp boat) prepared for each one. This is a time consuming operation, and safety may be compromised before all aircraft are re-identified. Finally last, but not least, is the lowering of the PVD (radar console). This operation was supposed to be so simple that a 90 pound female could do it unassisted. I have seem two burley technicians have difficulty raising and lowering a PVD, in addition to encountering problems myself. This operation is not optional, but mandatory since target markers will not stick to a vertical radar scope.

Assuming all this is done, you are now in the Broadband mode. It now may be necessary to retune the radar. (This should be done or checked at the beginning of the shift but traffic sometimes does not permit this.)

In addition, all other facilities must be notified of your Broadband status since they may be yelling at you to accept automated handoffs on aircraft entering your sector. Again, the possibility of compromised safety and more pressure on the human element.

I have attempted to relate to you the problems and short comings of RDP and the traumatic experience of a radar outage.

If I have succeeded, I am pleased and hold hope for the future. However, if I have failed, I am apprehensive about the safety of the flying public utilizing this system.

Jimmy L. Hines

RDP is good and very useful when it is operating properly. However, it does not always work properly.

The safeguards built into the system, to inform the controller when the RDP has stopped updating, seldom work. There are times when the controllers do not realize the RDP is not updating. When they finally realize RDP updating has stopped, they must then make the decision of reverting to Broadband radar or waiting for the RDP to return to normal operation.

If the controller determines he cannot wait for RDP to resume to normal operation, he reverts to Broadband and a long process begins. The reidentification process necessary can be very time consuming. The fact that it is a time consuming process leads some controllers to take the chance of waiting for the RDP to return. If the RDP does not return their change over process can become even more difficult.

The Broadband system has at times been very lacking of quality. You might revert to Broadband and find you do not have beacons. Yet at the time you checked it, when you came on duty, the beacons were fine.

Ronald L. Busch

Duane D. Mustard

John R. Burge

On October 3, 1976 I was assigned to Louisville High tracker position (FL 240 & above). We were working approximately 10 or 12 aircraft, when suddenly without warning, the RDP system failed. I'm not exactly sure how long the system was out, but the area supervisor came around and said the system was back and that we could revert back to RDP as soon as feasible. This was an impossibility for us, as we had approximately 16 aircraft we were working at the time and it was getting busier. This sector was the last one in the Center to revert back to RDP. It is practically impossible to switch from one system to another with that many aircraft, so we just had to wait until we had a light work load to start tracks and get the system going again.'

We had two aircraft northbound on J89 at the same altitude with eight miles separation on the RDP system. When we lost RDP we were down to a bare five miles separation on Broadband Radar. It was a mad scramble to keep these aircraft at least five miles apart and to increase separation.

My overall view of RDP is that it could be a good system, but as it stands now it is unreliable, has too many outages, freeze-ups of displays and blinks which occur to make it a really safe and dependable system. I would hate to see two aircraft have a mid-air collision before something is done to make this system safe and reliable.

Danny C. Hanson

October 13, 1976

Radar Data Processing, RDP, is a good tool for controllers when it is working properly. What I mean by this, is that it blinks too often. Some of these blinks might only last for five seconds, others for longer, possibly hours.

The worst is when everything on your scope freezes, nothing moves. This is referred to as "Display Frozen", which sometimes displays on your scope. When this happens, it takes the controller longer to realize that it has happened. There is no indication that he is not receiving updated information.

There is no way for me to say how often or for how long these blinks last, but they are a hazard to air safety.

Example:

Approximately five months ago while working the Ind Sector, I was controlling approximately ten aircraft. When the RDP failed, I immediately went to broadband. This consists of lowering the PVD, making up chips for all aircraft, giving handoffs manually, receiving handoffs manually, changing aircraft from discreet to nondiscreet codes and trying to keep all aircraft separated. During all of this, I was extremely busy in the Northeast area of my sector. This is where most of my aircraft were, and I overlooked one southbound aircraft. I did not change his code, so I could not readily display him on broadband. After things smoothed out and slowed down, I noticed this aircrafts strip still on the board. There was an altitude change request on him that I had not issued. I immediately idented him on the correct code and called the other sector. I pointed him out to them and was told to climb him immediately, which I did. The other sector controller then called me back and advised me that SDF approach control was separating the two aircraft, the other aircraft being the reason for the requested altitude change. Air Traffic Control did not separate the two aircraft, luck did in this case.

No matter what FAA says, it is impossible to instantly revert back to broadband radar. It is extremely hard to tell a desk jockey anything that he does not want to hear.

There are many problems with the ATC system, but RDP failures is the major one.

Michael Roll

Michael Roll

I feel RDP is a good and useful piece or equipment for ATC. However, I also feel that the reliability of this equipment was not high enough when we went ORD, to insure a safe operation. And it is still not up to the standards needed to operate safely.

The tension has increased under RDP due to a constant fear of blinks, prolonged blinks and flops.

Being caught in a prolonged blink or RDP flop with a number of aircraft is a most frightening experience to say the least. It has happened to me many times and it is a very lost and frightening feeling that goes through you. Even when RDP blinks for only a second or two, for those few moments all the worst goes through your mind.

They talk about an automatic back-up system to the RDP. This looks good on paper, but does not work very well in the real world. Most aircraft are on codes that are not picked up on Broadband. When you have all aircraft come up on the right code and start tracking on these aircraft, 5 minutes can easily pass. Even then if an aircraft does not hear the code change, something terrible could happen. Losing aircraft in a change from RDP to Broadband has happened. We have been lucky so far.

I do not feel RDP should be turned off because basically it is a good tool. But the reliability needs to be improved and its problems fixed as soon as possible.

Roy Slanaker

Roy A. Slanaker

RDP is a good and beneficial tool for the air traffic controller. Its' presentation is clear and concise, with many advantages over the old Broadband system. However, one factor which has plagued the system since ORD, is its reliability and dependability. Momentary blinks, sixty second start overs, to occasional complete flops, continue to hamper the system daily.

The controller can work around these problems by either waiting for the system to re-start, or revert back to the old Broadband Radar. In either case, the air traffic controller's judgement is impaired and his decisions, under these conditions, can result in less than standard separation minima.

Eliminations of these RDP problems is vital if the controller is to provide and maintain air safety.

David Richardson

## Appendix 2—FAA News Release, November 2, 1976

FEDERAL AVIATION ADMINISTRATION NEWS RELEASE
FOR RELEASE TUESDAY
November 2, 1976 Area Code 202-426-8521

### FAA AWARDS $11.2 MILLION CONTRACT FOR ATC BACK-UP SYSTEM

FAA Administrator John L. McLucas today announced the award of an $11,230,138 contract to the Raytheon Company of Wayland, Mass., to provide a back-up capability for the semi-automated systems installed in FAA's 20 air route traffic control centers in the continental United States.

Called Direct Access Radar Channel (DARC), the Raytheon equipment will take over when the primary system fails or is shut down for scheduled maintenance. Using minicomputers and associated equipment, it will process radar data on aircraft under center control and present this information in data-block form on the radar displays used by air traffic controllers. Items in the data block will include the identity and altitude of aircraft equipped with beacon transponders and altitude encoders.

Raytheon will provide 22 DARC systems under the contract. In addition to the 20 domestic air route traffic control centers, units also will be installed at the FAA's National Aviation Facilities Experimental Center (NAFEC) in Atlantic City, N.J., and the FAA Academy in Oklahoma City.

The DARC systems will replace broadband radars now used as the back-ups at the centers. Since broadband radar does not provide data tags for aircraft targets, its use requires controllers to swing the radar displays from a vertical into a horizontal position so that small plastic identification tags can be placed next to the aircraft targets on the scope. In addition to the problem of delays in repositioning the display units and preparing data tags, the broadband radar has become costly to maintain and operate.

Delivery of the first DARC system to NAFEC is expected in 18 months, the second unit for the FAA Academy six months later and the Centers will begin receiving their systems five months after that. All deliveries will be completed within five years, but it will take six years before all the broadband radars will have been phased out.

## Appendix 3.—Air Route Traffic Control Centers (ARTCC)—U.S.

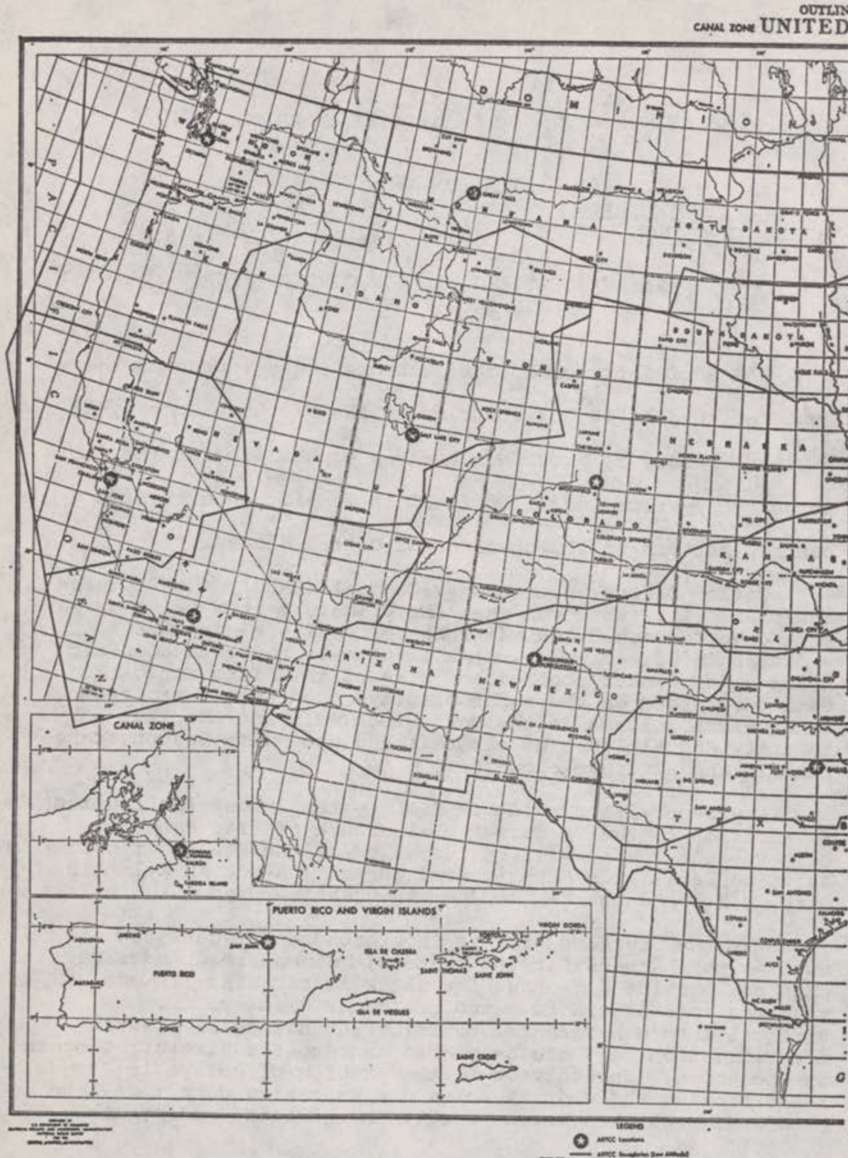
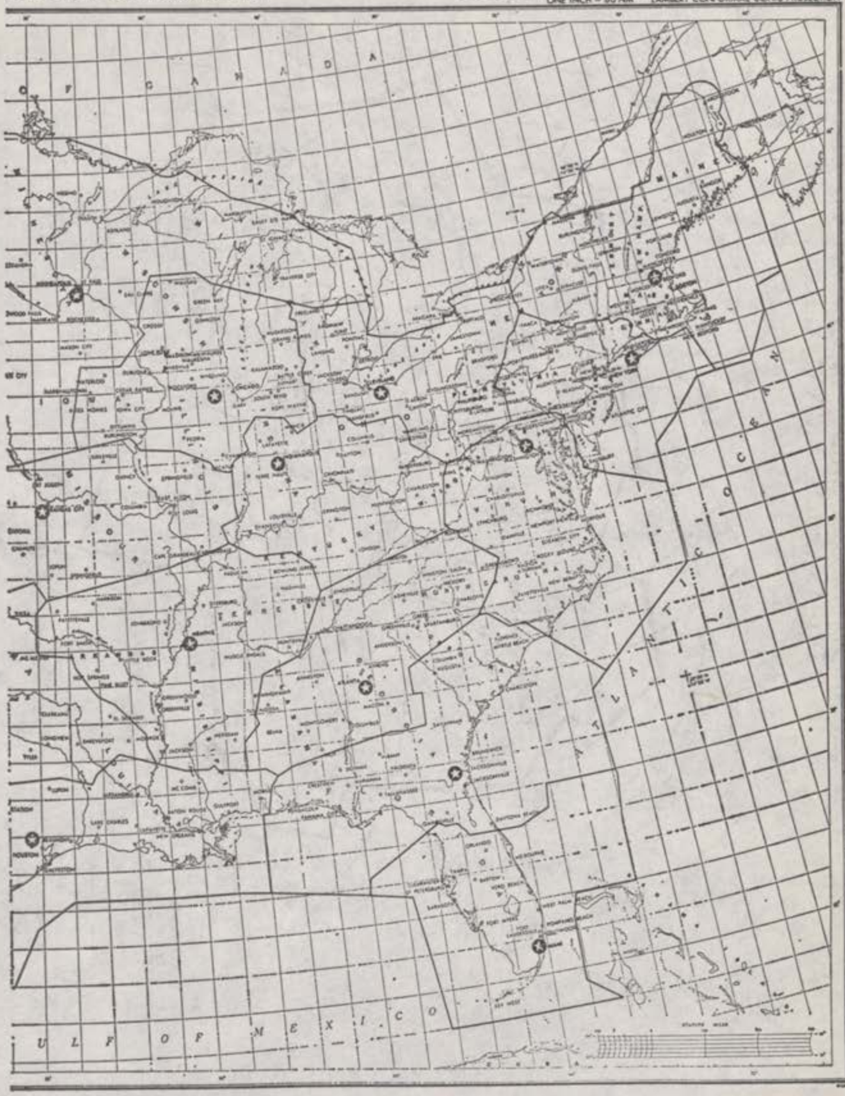


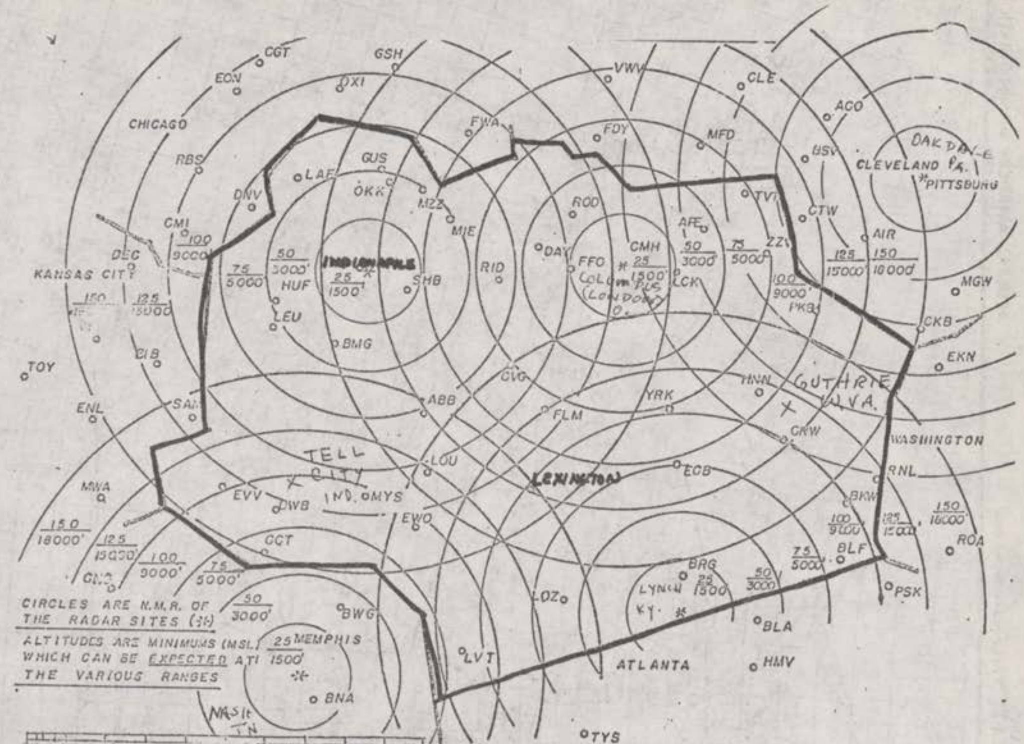
CHART
STATES PUERTO RICO AND VIRGIN ISLANDS

FEDERAL AVIATION ADMINISTRATION
ONE INCH = 60 NM LAMBERT CONFORMAL CONIC PROJECTION




AIR ROUTE TRAFFIC CONTROL CENTERS (ARTCC) 21 OCTOBER 1973

# APPENDIX 4.—EXPECTED AREAS OF RADAR COVERAGE, INDIANAPOLIS ARTCC AREA



## Appendix 5.—FAA Brochure Describing Outage Problems and Remedial Actions With Respect to Air Route Traffic Control Centers—Indianapolis and All Centers (August 1976)

INDIANAPOLIS

AIR ROUTE TRAFFIC
CONTROL CENTER

SYSTEM OPERATION

Prepared by: Federal Aviation Administration

Airway Facilities Service

Automation Engineering Division

AAF-610

79-971 O - 77 - 8

PURPOSE

This brochure has been prepared in response to a letter from Congressman Dave Evans, 6th District, Indiana, to Mr. Bob Whittington, FAA Special Assistant for Legislative Affairs, dated August 4, 1976.

Congressman Evans letter requested that an investigation be conducted in response to recent articles in the Indianapolis Star which quoted controllers assigned to the Indianapolis Air Traffic Control Center as saying that the displayed radar data they use for Air Traffic Control is unexpectedly lost momentarily on a daily basis.

Included within this portfolio is a description of the problems mentioned in the newspaper articles and the actions taken or planned to resolve them for Indianapolis as well as for all FAA control centers.

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## EXECUTIVE SUMMARY

Air Traffic Controllers have been quoted in recent Indianapolis Star newspaper articles as saying their "scope" goes blank unexpectedly on a daily basis while they are controlling traffic.

While this is true, the blanking usually is only for a matter of seconds and is not considered to have an affect on the safety of air traffic operations.

These momentary blinks are caused when the automated system experiences an interruption due to a hardware failure, software abort or some trouble related to the power input to the facility.

The problems identified at Indianapolis are not unique. All twenty ARTCC's are subject to the same occurrences to a degree.

Actions are underway to collect data, report system interruptions and provide for better followup of problem resolution than has been experienced in the past. Additionally, future plans call for improved maintenance and troubleshooting schemes which will minimize the number of these system interruptions.

It is safe to say, that the FAA is aware of the system troubles such as reported at Indianapolis and has actually initiated some immediate solutions as well as planned for more permanent long term solutions.

It should also be noted that since the time of system commissioning, the number of these momentary interruptions have been reduced significantly. However, as controllers have become more and more dependent upon the automated system, the tolerance of momentary "blank scopes" has become less and less. Thus, the increased concentration to eliminate their occurrences whenever possible.

## BACKGROUND

En Route National Airspace System consists of highly complex automated equipment.

Indianapolis Air Route Traffic Control Center NAS System commissioned 8/74 - one of twenty such centers in United States.

System is continually changed to improve operation and service to user:

1. Hardware modifications
2. Software updates

System reliability at Indianapolis in CY-76 less than in CY-75 (%91.87 vs %86.90)

Increased outages and lower reliability led to start of problem investigation in May 1976.

During May thru mid-July 1976, enough rough data was collected to determine that a more concentrated effort must be pursued to reduce system interruptions.

July 16, 1976 - Newspaper article identified controller dissatisfaction with system interruptions (blanking scopes) at Indianapolis.

FAA conducted a conference call on 7/26/76, with all regions and discussed the seriousness of the interruptions. A new reporting procedure was identified.

Congressman Evans letter of August 4, 1976, identified his concern over system operation and controller allegations at Indianapolis.

## PROBLEM

### National

System interruptions can be classified into two general categories:

1. Momentary - under one minute which causes blank or frozen displays.

2. System Outage - over one minute which results in complete loss of data to the displays. Back-up radar display system is switched to in this case.

These interruptions are generally caused by one of the following reasons:

1. Hardware failures
2. Power/Lightning effects
3. Software aborts

### Indianapolis

System interruptions (blank scopes) reported by the controllers at Indianapolis are no different than what has been observed at other ARTCCs:

1. Momentary blanking of scopes
2. System outages of one minute or more

In reviewing interruptions at Indianapolis for the period 6/1 - 7/10/76, the following problems and numbers of occurrences were identified:

1. Momentary blank scopes - 97
2. System Outages - 29

Causes of blank scopes were:

28 - Manual and coordinated with ATC
32 - Software (corrected by patches)
8 - Hardware intermittent failures
9 - Power interruptions
20 - Still under investigation

PROBLEM (CONTINUED)

Causes of the system outages were:

15 - Software (corrected by patches)
4 - Hardware intermittent failures (corrected by equipment modification)
7 - Power interruptions (lightning strike)
1 - Manual and coordinated with ATC
2 - Still under investigation

Additionally, during April and May 1976, the Indianapolis ARTCC was involved in testing and implementation of a new software update. This contributed to system interruptions while the new software "bugs" are detected and corrected.

## Actions (National)

### Current and Near Term

Software Aborts:

Generally, a more concentrated effort to reduce system interruptions started in April 1976 with the implementation of key site testing on all new software updates.

Key site testing is designed to test a new software update at a few ARTCCs and correct any defects prior to implementing the new software on a national basis.

Hardware Failures:

Headquarters conducted a telephone conference on July 26, 1976, with regions related to system interruptions. More stringent guidelines for investigation and followup of all system interruptions were stressed.

Revised reporting procedures are being implemented for improved tracking, identifying and resolving various types of system interruptions. Past reporting included only outages of one minute or more. New report is for all interruptions.

A conference is scheduled in September 1976 with all facility managers to address the system problems and identify the appropriate followup actions for continued resolution of all troubles.

Power/Lightning Effects:

Investigative teams visited three ARTCCs during July 1976.

During August 1976 a modification to the power system was accomplished as a result of the investigation. PCS recently installed at all ARTCCs to eliminate effect of commercial power loss on automated equipment.

Lightning strikes identified as major cause of power interruption where cables are not shielded between PCS and automated equipment.

Lightning surge protection on cable entering ARTCC from PCS identified as another requirement to eliminate momentary power interruptions to computers.

## Actions (National)

### Long Term

Software Aborts:

1. Continue key site testing concept.

2. Revise testing procedures for newly developed software at NAFEC to insure all aspects of program coding is checked before software is shipped to key sites.

Hardware Failures:

1. Conduct periodic automation conferences with regions. First one scheduled in February 1977.

2. Develop plan by February 1977 for improved proficiency of technicians in the maintenance and troubleshooting of automated system troubles.

3. Provide improved test equipment for troubleshooting.

4. Provide improved maintenance diagnostic software which will significantly enhance the technician's ability to troubleshoot and eliminate causes of interruptions. Completion expected in November 1977.

5. Increase number of expert troubleshooting teams for more expedient assistance to site having difficult problems.

6. Replace present radar backup system with an automated backup system. Planned implementation during 1979 and 1980.

Power/Lightning Effect:

1. Improved outage reporting will be put into effect to expedite problem identification and resolution.

2. Cable shielding between buildings will be scheduled for a future budget year.

3. Surge protection will be completed at all ARTCCs by December 1977.

4. Lightning protection will be completed in 1978 and 1979.

5. Investigate power/equipment interface related to short duration power interruptions in 1977.

<u>Actions (National)</u> (Cont')

**Power/Lightning Effects:**

Preparation of preliminary design guidelines for lightning protection have been contracted for and are expected to be available by December 1976.

## Actions (Indianapolis)

### Current and Near Term

Software Aborts:

1. Software patches are installed to correct immediate problems.
2. Development of more thorough test procedures for new software at NAFEC.

Hardware Failures:

Problems at Indianapolis over the past two months have been corrected by equipment modifications and repair of failed components.

National Telephone conference on July 26, 1976 instituted revised reporting procedure to identify and better attack system problems.

New reports will cover All system outages - not only those of one minute or more as in past.

Indianapolis representatives will be participating in a national conference in September 1976 to discuss system problems.

Power/Lightning Effects:

During week of July 5, 1976, a team investigated power problems resulting from lightning strike on June 29, 1976.

Investigation uncovered damage to the Power Conditioning System (PCS) which has since been corrected.

Results of Investigation:

1. Power system modification has been installed.
2. Cable shielding between PCS and ARTCC buildings identified as required.
3. Improved lightning and surge protection (currently planned) was confirmed to be a necessary step in eliminating future outages.

## Actions (Indianapolis)

### Long Term

Software Aborts: Same as national plans.

1. Continue key site testing
2. Test new software releases more thoroughly at NAFEC before release.

Hardware Failures:

Site to report All system interruptions for improved identification and follow up on system descrepancies.

Regional representatives participate in national automation conferences.

Provide improved test equipment for troubleshooting system problems. Logic analyzers (high priority requirement) will be provided to Indianapolis early 1977.

Investigate the feasibility of establishing an expert troubleshooting team in the regional office at Chicago.

Replacement of the present radar backup system with an automated system in early 1980.

Power/Lightning Effects: (Basically same as national plans)

More comprehensive outage reporting will be put into effect to expedite problem identification and resolution.

Cable shielding between buildings will be scheduled in a future budget year.

Surge protection will be completed by mid 1977.

Lightning protection will be completed in 1978. Contractor preliminary design is expected by December 1976.

## Conclusions

System interruptions, as reported by the controllers at Indianapolis, are real and valid causes for high level concern.

The high number of short system interruptions causing "blank scopes" has been the subject of FAA scrutiny since May 1976.

Prior to setting up formal procedures to track and resolve these problems, the FAA had taken several steps to improve system operation. Namely, improved troubleshooting equipments and associated maintenance techniques were already being pursued. Additionally, steps had been taken to revise the testing philosophy of new software packages as evidenced by the adoption of the key site test concept in April 1976 (test software at a few sites to resolve troubles prior to national implementation).

However, since the effect of interruptions on a national basis have become more serious, an increased emphasis on programs designed to reduce the number of occurrences has surfaced.

Many hardware and software changes have been identified for implementation in the NAS system as a result of this increased emphasis. Some have been or will be accomplished in the very near future since they were already planned. Others will be implementated in future years when budgetary funds become available.

Finally, it can be said that a more concentrated effort is currently underway to improve the system at all levels of the FAA. Even though it must be recognized that the system is a very complex and sophisticated combination of man and machine interface, the FAA feels confident that with implementation of the required system changes a more satisfactory system operation will be attained.

# APPENDIX 6.—GLOSSARY OF ACRONYMS

ARSR - Air Route Surveillance Radar, a long range radar system serving the ARTCC for enroute traffic.

ARTCC - Air Route Traffic Control Center, a major facility providing enroute air traffic control service.

ARTS - Automated Radar Terminal System, a computer system working with an Airport Surveillance Radar.

ATCT - Air Traffic Control Tower.

BEACON - Common name for secondary radar (SECRA) using a coding system transmitted and received bewteen ARSR site and aircraft.

CCC - Central Computer Complex, the master computer containing the NAS operational program.

CD - Common Digitizer, located at remote radar site to convert radar video to radar data.

CDAT - An outage reporting code representing the combined RDP/FDP service.

CDC - Computer Display Channel, the computer which processes and displays the radar data (located at 15 ARTCCs).

CRD - Computer Readout Device, a small picture tube device used to write alphanumerics for messages to and from the computer.

CRAD - An outage reporting code representing the RDP service.

CUE - Computer Update Equipment, equipment used to enable the controllers to communicate with the computer.

DARC - Direct Access Radar Channel, a future system to provide display capability to controller from one specific radar system in the event of total computer failure ( a backup system).

DCC - Display Channel Complex, the computer which possesses and displays the radar data (located at five ARTCCs).

EMSAW - En Route Minimum Safe Altitude Warning

FDEP - Flight Data Entry and Printout, a remote device located at ATCT for transmission of flight plan data between tower and center.

FDAT - An outage reporting code representing the FDEP service to towers.

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FDP - Flight Data Processing, the automated service used to provide all requirements for flight plan information.

FSP - Flight Strip Printer, printer flight strips at centers and towers for controller's use.

FSS - Flight Service Station, provides weather information to pilots and transmits IFR flight plans to centers.

PCS - Power Conditioning System, a system used to generate AC power without interruption using commercial power, engine generators and batteries as a source.

PVD - Plan View Display, the disply used at centers for all radar data and associated alphanumerics.

RBDE - Radar Bright Display Equipment, equipment used to provide broadband radar capability at the center.

RCAG - Remote Communications, Air/Ground, remote receiver and transmitter located throughout the ARTCC flight advisory area for controller/pilot communications.

RDAT - An outage reporting code representing the radar service from one radar site.

RDP - Radar Data Processing, the automated service used to provide all requirement for displaying radar data.

SECRA - Secondary Radar, also commonly called BEACON. Uses a coding system transmitted and received between aircraft and ARSR sites.